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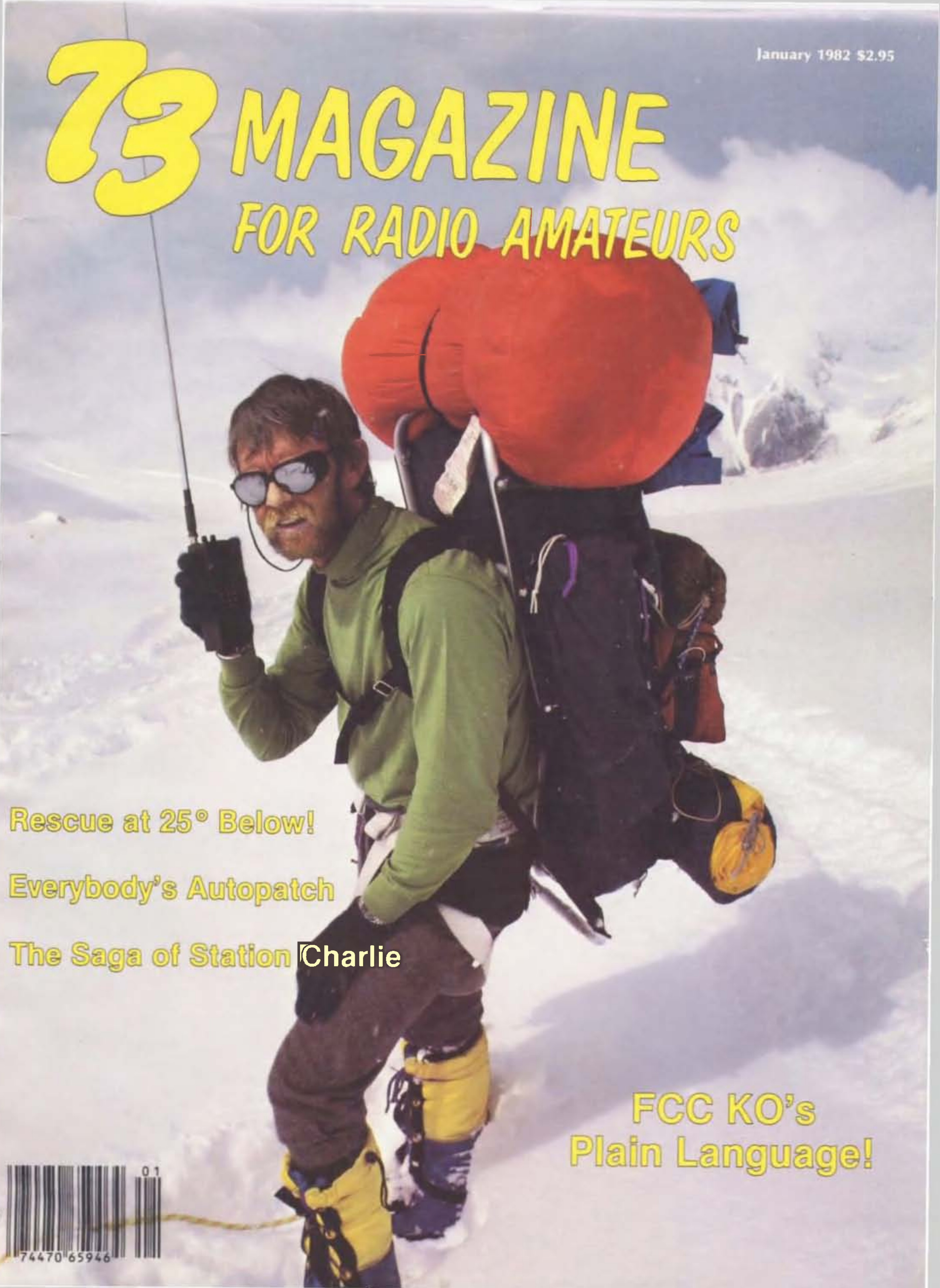
73 MAGAZINE FOR RADIO AMATEURS



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The Saga of Station Charlie

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73 MAGAZINE

Cover: Photo by Bob Bonar.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

DANNALS NEW GENERAL MANAGER!

That's the headline that's coming up next year for League members. Oh, there is an underground movement to upset the well-laid plans of Baldwin and his decreasing number of loyal supporters on the board of directors, but nothing really serious is expected to come of it.

These malcontents are fomenting unrest in several areas, but League headquarters has met that problem before and surmounted it, so it is confident that all will go as planned this time.

Indeed, anyone with a knowledge of the history of the League has to appreciate the years of devotion that Dannals has given and his adherence to maintaining the continuance of tradition. He is in the mold of the outstanding leaders of the past such as. . . by golly, let me think a minute. . . er. . . Huntoon and. . . who was that guy before him?. . . oh yes, Budlong.

We have to remember that Harry stood graciously aside so that Mort Kahn could be elected as Hudson Division director in what turned out to be a major turning point for both amateur radio and for our country. Mort, being a very strong person, took over the League for several years. . . forcibly retiring Budlong, organizing the building fund coup, and initiating the proposed return to pre-WWII licensing in 1963.

We can certainly chalk up the tremendous success of the amateur exhibits at both the Coca-Cola and Venezuelan exhibits at the World's Fair in New York to Harry and his tireless work for the League.

Getting facts on Harry's background is not easy, but my recollection is that he started from a position at a company in New York which made radio equipment and first became the president of the Hudson Amateur Radio Council. From there he was so supportive of the League that the rules prohibiting people making radios professionally from becoming League officers was ignored and he was permitted to run for ARRL director, anyway.

Though the betting was that Harry would be decisively defeated, the vote, if I remember right, was a tie! The opposition, showing poor sportsmanship, accused HQ of voting irregularities and there was talk of trying to initiate envelopes for the ballots which could not be shadow-sorted before the official counting. The vote rerun saw Dannals elected.

Again, we are seeing poor losers in the directors' sweepstakes griping for piddling reasons. Lyndon Johnson showed us that it really didn't matter *how* you won, it was what you did afterward that counted . . . for those of you who are up on your history of LBJ's first election win.

After all, it is the prerogative of HQ to edit the brief histories of the contenders on division ballots, so if almost all of the background of someone who looks like they are not going to be a team player has to be edited out, that's the breaks of the game and it is poor potatoes to beef about it. Many feel that Harry is absolutely right to want to sweep that sort of bickering under the rug where it belongs.

When it comes to running something as big as the League, loyalty and devotion to the HQ mystique are far more important than business experience, so many are hoping that the rather obscure ads for candidates for the General Manager's job will go unnoticed. The League isn't supposed to be a commercial business anyway. . . it is a membership club to promote amateur radio's growth and health. We don't need some big outfit milking every dollar it can from the members, whose average age is increasing and who are heading towards retirement and a fixed, low income.

Amateur radio. . . and the League. . . needs a general manager who is respected. . . one with brains and foresight. . . with a long history of coming up with good ideas and helping the League to prosper. One of the last things we need is a stuffed shirt who is pompous and self-important, complete with jacket and tie. Amateur radio is a hobby. . . it's for fun, despite our ability to provide many services. So our national organization should be headed by a relaxed, technically-expert ham, one who has gone into every aspect of the hobby personally. . . DXpeditioned, has a high DX score . . . into SSTV. . . RTTY. . . and so on. Let's all hear it for Harry.

Remember that Harry is getting on in years. . . and that a union steward doesn't make a lot of money. As General Manager, he might be able to make around $100,000 a year. . . which is in line with the importance of the job. I think that a lot of people would like to see Harry really make it big for a change. And that's certainly a reasonable salary for someone running something as big as the ARRL. That would help make up, too, for all of the years he has put in at no salary as president of the League. It's the least we owe him. . . right?

A few years as General Manager and then he will be able to retire again (I understand he is retiring soon from the union) and live the good life on one of the legendarily-generous League pensions.

POWER STRUGGLE

Yes, there definitely *is* a war going on within the ARRL board of directors. The war is over who will control headquarters, with one side loyal to the power group which has run the League ever since Maxim died in 1936 and the other trying to get the political machine out and replace it with some professionals who, they feel, will run the League for the benefit of the members instead of the clique.

I've always been amused at the blind loyalty of tens of thousands of amateurs to this small group which holds the loyal in utter disdain. Perhaps followers who question not, who

FCC DUMPS PLAIN LANGUAGE!

The FCC has decided to drop its proposed major rewrite of the Amateur Radio Service rules due to overwhelming opposition from the amateur community. In taking the unanimous action on November 12, the Commission noted that, should the amateur community at a later date wish to pursue on its own a general rewrite of the rules, the Plain Language docket might prove helpful.

Although amateurs objected to many specific parts of the Plain Language proposal, it was the general tone of the docket that bothered most hams. The proposed elimination of the five-part Basis and Purpose of amateur radio in section 97.1 of the rules, along with a change in name from the "Amateur Radio Service" to the "Amateur Telecommunications Service," were seen as diminishing the status of the service.

Look for more on the FCC's decision to drop the Plain Language proposal in next month's Kahaner Report.—WB8BTH.

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accept everything without question, deserve to be held in such contempt.

Eventually things begin to change and, fight as they do, with dirty deals such as they handed ex-director Miller, the clique is beginning to lose strength. More and more reform-oriented directors have gotten on the board and are sickened by what they've found at HQ. The reformers want to throw out the scoundrels and get in some new blood.

Well, I say, "better the devil you know than the one you don't." The League is doing well, considering the virtually terminal health of the hobby itself. Most of the amateurs I've talked with have a strong death wish for the hobby . . . "we don't need any more hams . . . the bands are already too crowded" . . . and, "we don't want any technical changes . . . we like CW and sideband." Many feel that only Extra Class amateurs should have phone privileges . . . as the ARRL HQ proposed in 1963.

A great many amateurs feel that since the politics of amateur radio is complex . . . and after all, this is *only* a hobby . . . it's better to leave everything to the ARRL. Who should know better than HQ what should be done?

The ad in the November *QST* (page 21) for people interested in the General Manager job which will be open when Baldwin steps down in March was run, apparently, as a sop to the starry-eyed reformers on the board. Little is expected to come of it. Indeed, even though the general membership has no vote in the election of the highest offices . . . General Manager, Editor of *QST*, and President of the League . . . or in *any* of the other HQ offices . . . the leading contender, Dannals, is said to be making a 50-state campaign tour (*he* said he was making the tour during his recent talks at Peoria and Louisville). As far as anyone seems to know, this campaign tour is being paid for by the ARRL.

Since there is nothing that you can do now anyway, why worry about all this silly political stuff? The directors who will make your decisions for you are all in place and the old-timers still have everything under control, so it's probably best to forget about the whole thing. After all, as many amateurs say, if we lose amateur radio we can always take up photography.

CLUB 'EM

One of the major problems with ham clubs is that so few hams know how to run them. Furthermore, the whole thing is often a self-defeating system. You see, if there is a turnover of the people running the club . . . as there should be to keep a club healthy . . . the newcomers usually will not be able to benefit from the experience of the chaps who ran it earlier. The re-

Well . . . I Can Dream, Can't I? by Bandel Linn K4PP

"Your kid sounds so good, I've decided to cast him in my next picture! He'll get $10,000 a week!"

Reader Service for facing page ✓15→

suit is that the same mistakes are made over and over.

If the club is in the clutches of an old-timer clique, as many are, this is a bad situation, too. Oldtimers really don't want newcomers In the club and they tend to make the club boring and a put-off for youngsters.

Many years ago I ran a series of articles on how to run a ham club. It was so popular that we put it out as a book. Well, that was quite a few years ago and it is time for some new ideas. I'd like to see some articles by those of you who have made ham clubs work...telling the rest of us how you did it.

The main strength of amateur radio lies in the clubs, so we all have a vested interest in keeping our clubs alive and well.

You know, I wrote several months ago, asking...no, daring...clubs to send in pictures of their groups for publication. Nothing yet. When you get together for Field Day, an outing, a hamfest, an auction...any group activity...take a few minutes and get everyone together for a photograph and send it in. I'd even like to see some interesting ones (in color) on the cover.

Getting back to the clubs... and the rotation of officers. I would suggest that you elect a president for one year only... and at the same time elect a vice president whom you want to be the president next year. Keep the ex-president on the board of directors so you will have continuity. This will help the president pass the word along as to what does and does not work... why the club did such and such two years ago, and so on.

One word of guidance... remember that the club meeting is show business, not club business. Keep as much of the club business in the board of directors as you can and this will make the general meetings a lot more fun.

Be sure you have a welcoming committee which will keep an eye out for any newcomers to your meetings. Make it a point to get acquainted and keep them busy talking about themselves for the first two or three meetings. You won't be able to chase them away with a stick.

Arrange for any members with special interests to communicate their interest to the rest of the group. You may have a red hot DXer who would love to tell about the rare ones he caught recently...and will bring in the new cards he's gotten. He can also get other members interested in DX and tell them how to go about it.

You'll find chaps interested in SSTV, RTTY, computers, moonbounce, aurora communications, high-speed CW, and so on. Give them their chance to show and tell. I've already mentioned giving the home builders more than their share of the spotlight. Look for any special interest...contests, certificates, traffic handling, whatever...and get 'em up to talk and show.

New gear is of interest, too. Perhaps someone has gotten one of the new Drake keyboards...well, bring it in and show it. That's a complex piece of gear and few hams really understand what it does. We all want to see the newest gear. I always used to lug the newest stuff and I had a tough time getting it back at the end of the meeting.

If you are saddled with a bunch of hoary old-timers who sit by themselves at the back of the meeting room, figure out how to get them up front where they can get in on what is happening. The more you can get fellows together, the more they will enjoy the meeting. I really hate it when I see a club meeting where fellows sit about four seats apart, with a few up front and most toward the rear. This means they are not really into what is going on and are staying away as much as they can from the meeting and each other. Bad news. A speaker will really be put off by this. If you have a guest speaker, do not under any circumstances permit this kind of treatment. He came to speak to a group, not a room full of individuals.

Guest speakers? Easy, usually. Find anyone who is in the industry as a manufacturer or dealer and ask him in to talk.

Club events pull things together. How long has it been since the club set up a demonstration station in a shopping mall? If you do, remember you are selling amateur radio, not just putting things out for people to be confused. Make good graphic signs which explain what is going on. Try to make up some literature which will bridge

Continued on page 148

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Egad! A Nine-Tube Linear

—results from the W7CSD test bed

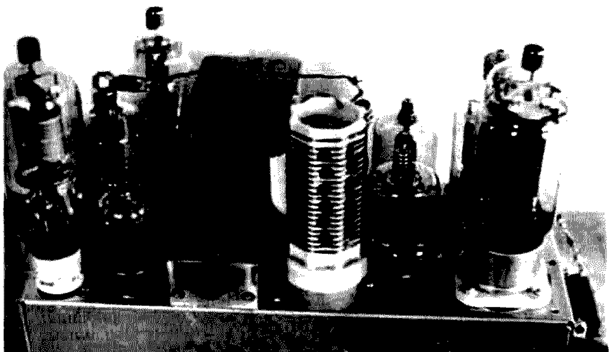
The photo bears out the title. But, no, I don't run all nine tubes in the amplifier at the same time. The photo represents the chassis used to test each of the tubes individually. I mounted all the sockets, wired the filaments and screen grids, but the plate and control grids were moved from tube to tube during the process of experimenting. In the case of grounded-grid, filament wiring also was altered.

What's the purpose of all of this?

There are a lot of reasons for buying an FT-7 or a TS-120V or an Argonaut. They are great for camping or for use where you have to use a battery. But at times you would like to have a little more power. Obviously, you could buy the TS-120S or the FL-110 linear or maybe build a solid-state linear yourself, complete with low-pass filters. But I have an apple box full of tubes. So, I decided to find out what kind of a tube linear would do the best job.

There are some problems.

Photo by Lois Kiger



The amplifier test chassis! Only one tube is used at a time.

Grounded-Cathode

First of all, you can scan the tube data in one of the older ARRL *Handbooks* and find that, seemingly, it is possible to build a kW amplifier that requires very few Watts of drive in the grounded-cathode configuration. You might have to neutralize the amplifier, but that is not a major concern. OK, so you build up this mighty fine structure and you try to get from the solid-state broadbanded driver to the grid circuit of your amplifier. If you just link couple, you will find that the impedance match is so bad that nothing comes out of your exciter. You can put 50 Ohms across the link (or in series with the link) and this will make the exciter much happier. You may get a little more out of the amplifier than the 10 Watts from the exciter but not much. I gave it up as a bad idea.

Possibly, you could design some impedance-matching network between a 50-Ohm generator and the grid in a class AB vacuum tube. But there ought to be an easier way.

Grounded-Grid Circuit

Another route seems to be the grounded-grid circuit. As will be seen, this has possibilities with some refinements, but it is very doubtful that with 10 Watts drive you can go to more than a few hundred Watts

input with a single stage. You easily could go to a kW with a two-stage linear. Actually, the commercial solid-state amplifiers are not getting a power gain much in excess of 10, either. Here, again, with grounded-grid, the input impedance varies from tube to tube and may be a country mile from 50 Ohms.

In the past, many companies have built grounded-grid linears with an untuned input. Hallicrafters, Loudenboomer, and DenTron more recently have done this, just to name a few. It worked very well if you had a 100-Watt tube-type driver. With the advent of 100-Watt broadband solid-state rigs, it doesn't work well at all. This is doubly true if you have a 10-Watt solid-state rig. So, DenTron and possibly others are installing tuned input circuits in their linears and marketing tuned input kits to be installed in existing amplifiers.

If you are going to build your own, two less-than-desirable conditions exist. First of all, you will have to wind a big bifilar-wound ferrite filament choke unless you use an indirectly-heated cathode tube like the 7094. Second, if you are going to get the maximum out, you will have to build a band-changing input tuner or half a dozen switchable, fixed tuned inputs for that many bands.

Tube	Plate Volts Ep	No Signal Plate Current Io mA	Plate Current w/excitation Ip	Grid Volts Eg	PA/P7*
6146	460	No	No		Less than 2:1
829B		Good	Good		(G3 tied to K internally)
6LQ6	900	5	200	−10	9:1
7094	1500	40	160	0	12:1
813	1500	10	60	0	2:1
4-125A	1500	5	35	0	1:1
4-400A	1500	20	86	0	6:1
3-400Z	1500	50	160	0	12:1
811	1500	35	65	0	1:1

Table 1. Grounded-grid amplifier test results. All grids tied together; untuned *input. *Power output of amplifier compared to power output of FT-7.*

EXPERIMENTAL RESULTS

Grounded Grid Circuit

Table 1 shows the results of driving seven different tubes with an FT-7, as shown in Fig. 1. The 6146 and the 829B tubes have the suppressor grid internally connected to the cathode and just don't function very well in grounded-grid. However, note the gain of the 6LQ6. If all you are looking for is 100 Watts out, this may be the answer. Most any TV transformer and bridge circuit will give you the makings of a power supply. The circuit is simple and does not require filament chokes. The 7094 is a dandy, but expensive. So is the 3-400Z and would be even better with 3000 volts. At a glance you could conclude the 813, 4-125, and 811 are flat tubes. Not so. They just mismatch 50 Ohms too far. The 4-400A is not so far off and also might look better with 3000 volts.

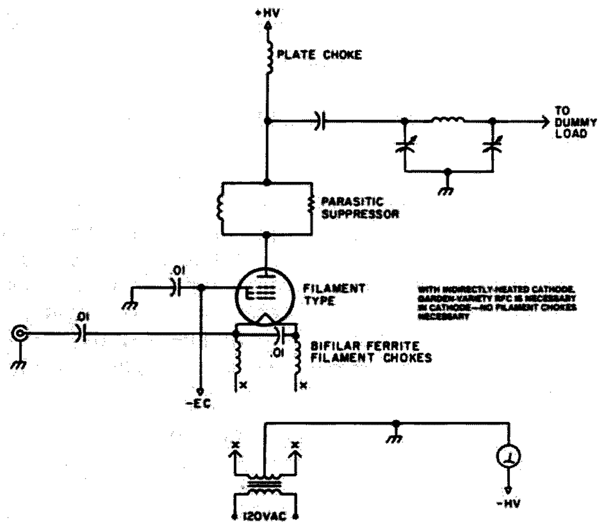


Fig. 1. Grounded-grid amplifier test circuit.

Table 2 shows data for the same amplifier with a home-brew antenna tuning unit between the FT-7 and the amplifier (Fig. 2). This unit was adjusted to give a 1:1 swr presented to the FT-7. Note that the power gain has skyrocketed in all cases. The 7094 gain has gone to 18:1! The 3-400Z might be nearly this high using 3000 volts. If you have an 811 in the junk box, it now looks like a winner at 12:1. Again, you might go this route with the 6LQ6. But you *do* have some kind of an input tuned circuit to add. It adds hardware, takes up space, and is another circuit that needs to be manually adjusted.

Tube	Ep	Io	Ip	Eg	PA/P7
6LQ6	900	5	210	−10	12:1
7094	1500	40	190	0	18:1
813	1500	10	155	0	14:1
4-125A	1500	5	80	0	10:1
4-400A	1500	20	135	0	12:1
3-400Z	1500	50	165	0	14:1
811	1500	35	125	0	12:1

Table 2. Grounded-grid amplifier test results. All grids tied together; tuned *input.*

Passive-Grid Circuit

A third possible approach is the "passive-grid" circuit. I built a big one of these several years ago, driven with an FT-101.[1] The 1979 ARRL *Handbook* has such a circuit, as does one of the older Bill Orr *Handbooks*. The ARRL used an 833, whereas the other one used some kind of a big tetrode. If you have a 100-Watt tube or solid-state exciter, it's a good circuit. With 10 Watts, and using a positive screen voltage, it may be attractive to some. The input impedance is 50 Ohms, almost all resis-

1. *CQ*, April, 1976, p. 31.

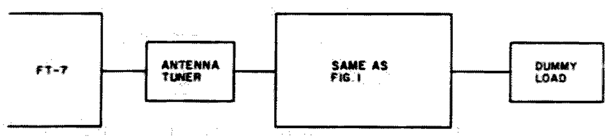


Fig. 2. Block diagram of test circuit of Fig. 1 using tuned input circuit (antenna tuner).

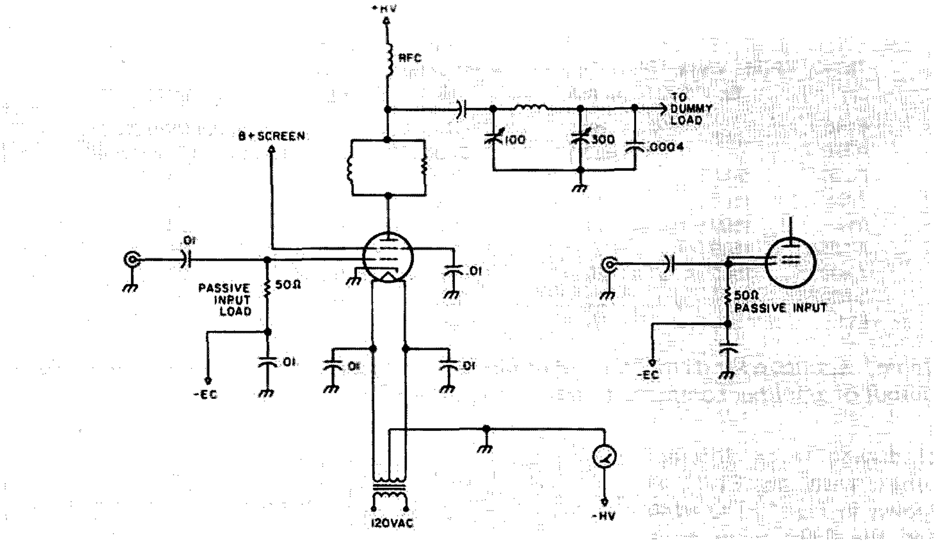


Fig. 3. Passive-grid amplifier test circuit. Screen grid is held positive.

tance. I used seven 390-Ohm 2-Watt resistors in parallel. This makes the FT-7 or other solid-state 10-Watt exciter very happy. Unfortunately, it also limits the amount of voltage that can be applied to the grid. The one disadvantage is the necessity of a screen supply. In the test case, the screen and control grid voltages were adjusted for optimum output. Control-grid voltage was supplied from batteries.

Table 3 shows the results of driving the passive-grid circuit (Fig. 3) and also applying optimum positive potential to the screen. The results compare fairly well with the grounded-grid untuned input. The 701A, which is not a common tube, is tops and the 7094 and 4-400 look fairly good. Again, the 4-400 would look better with higher voltage. The simplicity of the circuit has something going for it.

Table 4 is same circuit, except that it has all grids tied together, if there are more than one. This is singularly unimpressive although the 3-400Z still might look very good at higher voltage. Both of the passive-grid circuits might look much better if you had a 100-Watt driver and, of course, a 100-Watt non-inductive 50-Ohm passive-grid resistor.

OK, fellas, study the data and draw your own conclusions.

Having been a teacher for most of my life, I know this is not the way to end. I see some strange expressions on your faces. You, in the front row, what's your problem?

How did I do the experiment and how valid is the data?

The FT-7 was connected through an antenna changeover relay through the amplifier under test and through an swr meter (which was also calibrated for relative power) to a Heath Cantenna®. With the antenna relay not energized, the FT-7 was fed through to the load and the relative power was set to 10%. Then the antenna relay was energized and the amplifier fed to the load. If the meter reads 60%, we have a power ratio of 6:1. On the high output ones, I set the power meter at 100% with the amplifier on and then compared to the FT-7. If it reads 8%, then we have a power ratio of about 12:1.

In each case, the amplifier voltages and loading were adjusted for maximum power out without getting the plate too red. The actual power ratios may be a little in error, but the differences are so great that the conclusions are evident. An rf ammeter might be used if you choose to use one. Since I^2R equals power, $(I_{amp}/I_{FT\text{-}7})^2$ will give you the power ratio.

What was the frequency of the tests?

I originally planned on 80 meters, but the tank circuit wouldn't reach that far, so I used 40 meters.

How about the long grid and plate leads going to some of the remote sockets on the chassis?

Not good at all. But you can get away with it on 40 meters. Nothing even threatened to take off and oscillate. But you better get those leads much shorter if you expect to work on ten.

What will this thing do on a real live antenna rather than a dummy load?

It will do just as well and very likely better. If you have a good antenna with a swr of 1:1, it will behave just like the dummy. If you have an antenna with an swr of 2:1, the FT-7 output to the antenna will be considerably reduced, but the pi-network in the linear will overcome this and will have full output. Instead of a power ratio of 10:1, it might very well go to 12:1 or more.

What's the big difference between an amplifier for a 100-Watt exciter and a 10-Watt exciter?

Another very good question and one that a lot of you may not have thought about. If you have a 10-Watt exciter, you want to get all the power gain you can get. If you get a gain of 20, you still only have 200 Watts out. If you have a 100-Watt exciter, an amplifier with a gain of 6 is pretty good. You now have 600 Watts out and very near the legal limit of 1000 Watts in. A low-mu grounded-grid triode might be ideal. On the other hand, a

Tube	Ep	Io	Ip	Eg	E_{screen}	PA/P7
829B	460	10	200	−10	110	5:1
6146	900	20	100	−20	100	5:1
6146A	900	30	110	−20	110	6.8:1
6LQ6	460	30	100	−20	50	4:1
	900	30	130	−20	50	7:1
813	900	75	100	−10	250	2.5:1
	1500	100	130	−20	400	5:1
4-125A	1500	75	100	−10	200	5:1
	1500	75	100	−20	270	5:1
4-400A	1500	170	200	−20	270	10:1
	1500	170	190	−10	200	10:1
7094	900	25	170	−20	170	10:1
	1500	40	200	−20	90	12:1
701A*	1500	30	200	−10	70	20:1

*Table 3. Passive-grid circuit with positive screen supply test results. *701A—uncommon surplus tube. Used in identical circuit but another physical setup.*

Reader Service for facing page ✓41→

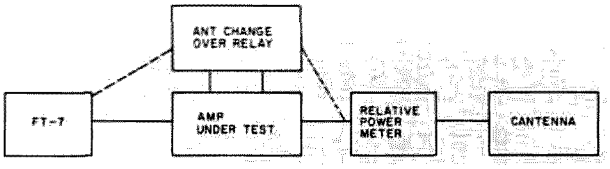


Fig. 4. Passive-grid amplifier test setup for common-grid configuration.

Tube	Ep	Io	IL	Ec	PA/P7
829B	460	5	130	0	5:1
	900	20	175	0	5.4:1
6146	900	40	90	0	5:1
6146A	900	30	100	0	5.4:1
6LQ6	900	10	125	−10	6:1
811	1500	20	50	0	2:1
813	900	0	30	0	1:1
	1500	10	50	0	1.5:1
4-125A	1500	0	30	0	Less than 1:1
4-400A	1500	25	75	0	3.2:1
3-400Z	1500	50	110	0	8:1
7094	900	20	85	0	5:1
	1500	40	110	0	8:1

Table 4. Passive-grid test circuit results after tying all grids together.

3-400Z (or 500Z) or a 4-400A in a passive-grid circuit would be quite adequate.

Which one did I decide to use?

Well, I built two. Both of them were chosen because I had the tubes. One was the grounded-grid, untuned input 7094 which I succeeded in getting inside a medium-sized cabinet complete with power supply. I can stick the outboard antenna (input) tuner in if I want to. The other uses the old Western Electric 701A in the passive-grid circuit with 70 volts on the screen. I had three of them and two sockets. (If anyone wants a 701A and a socket, make me an offer.) In any case, the decision rests on personal choice, what's in the junk box, and what you would settle for in the way of output.

A Bit of Confession

You would be surprised at the number of Master's and Doctoral dissertations that have been founded on a preconceived conclusion with a bunch of warped data to prove what the author already thought was so. Well, I had a preconceived conclusion that the passive-grid circuit was just great and everybody should build one. Before starting on this little data collecting venture, I had already built the 701A. Since it worked so well, it must follow that all passive-grid circuits are fantastic. As you can see, my data disproves this hypothesis. On the other hand, it turns out that I have built a good case for the tuned-input grounded-grid for just about any tube you want to choose. I never did try the 701A, grounded-grid, but I suspect that it would be excellent. By the same token, a 4CX1500A might be good in a passive-grid, but I don't have one.

If you have a strange unknown bottle in your junk collection, cobble up a junker linear and see what it will do. Then build a finished model using whatever circuit works the best.

Have fun! ■

Reader Service for facing page ✓ 70

THE RTTY ANSWER

Scott Nelson W7KUF
Box 56, Snowbird Village
Snowbird UT 84092

Drama on Mt. McKinley

—ice, snow, and amateur radio

At 13,000 feet and approaching Windy Corner.

It has been many years since the mountains started influencing my life. As a youngster living in New Hampshire, I remember reading books and looking at photos of far-away peaks bearing no resemblance to the rolling hills of New England. It took years, but in the early seventies I moved to Utah and took up residence in the Wasatch Mountains at Snowbird, one of the country's premier ski areas.

Now, snow-wise and educated in ice and avalanche perils, I sometimes long for the White Mountains of New Hampshire, realizing that a mountain doesn't necessarily have to be over twelve thousand feet and snowcapped to impress me. It was in camp at 14,400' on Mount McKinley, at −25°, when this thought first came to me. We had been climbing for six days before reaching this camp, and now we were into our third day sitting out an endless storm that buffeted our sturdy dome tents on this high ice field, not far from the arctic circle. Above us, Denali, as the mountain was known to the Indians, rose to over twenty thousand feet of ice, granite, and snow.

This was an expedition that had been six months in the planning and had drawn from climbers and skiers associated with Snowbird. Dick Bass, the Texas oilman and owner of the 'Bird, was there with his two sons and two daughters. Bob Bonar, Director of the Ski Patrol, and Liam Fitzgerald, Director of Avalanche Control, were both there, as well as Dr. Gernot Spalleck from the Medical Clinic. The expedition leader was Marty Hoey, Director of the Safety Patrol and an extremely capable climber. Among other notable credentials, she is a member of the China/Everest expedition for 1982.

It was early December, 1980, that plans began to materialize. We each embarked on a conditioning program that included weight lifting and running or bicycling in addition to our normal skiing. New equipment had to be purchased and tested—with safety of prime concern. It was the safety factor that first led me to consider taking ham radio along.

A quick check of the repeater directory confirmed the availability of two meters within range of the mountain. In mid-winter tests in the Wasatch Mountains, both my own Yaesu FT-207R and a friend's Kenwood TR-2400 proved unacceptable because of the whistles and bells, memories, displays, weight, and nicad drain. Quickly, it became apparent that the criteria for acceptance were small size and weight, simple operation, and synthesized frequency control. Both the Tempo S-1 and Icom IC-2AT fit the bill and tested out well. Through the assistance of the folks at Icom, I was soon outfitted with a new hand-held equipped with an alkaline battery pack, and I was ready to go.

The rubber ducky was discarded in favor of a quarter wave, but tests soon showed that it, too, would be marginal. One hike into the mountains with VoCom's five-eighths-wave whip convinced me that there was no other way to go, although at one time I did consider a collapsible three-element beam. Like other complicated solutions, it was discarded in favor of the simple whip. It was to provide the margin of safety we required.

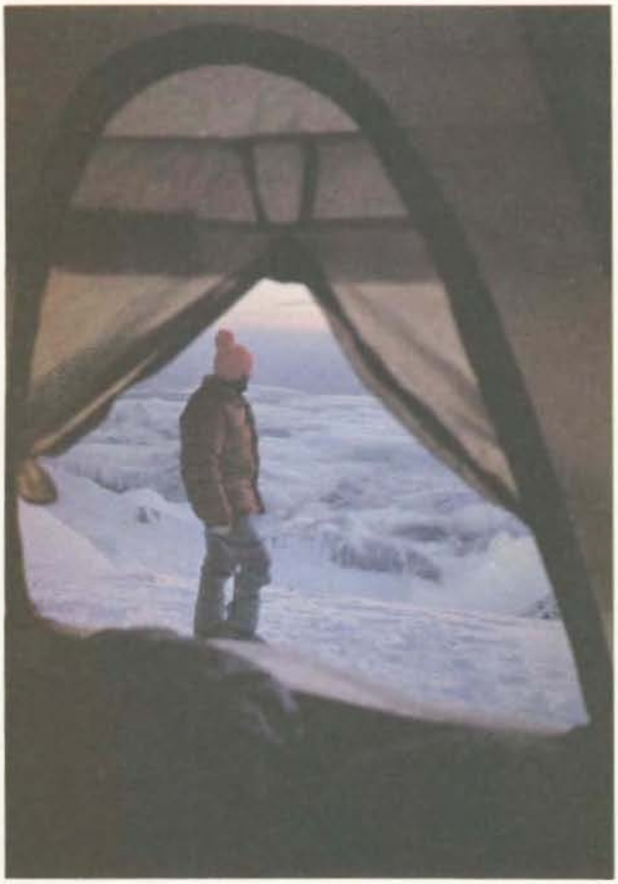
Next on the planning agenda was the Anchorage link station since I wanted to operate on 2 to 20 meters crossband and maintain contact with my family and ham friends in Salt Lake City. Several calls on 14.292 MHz soon brought Ray Morris KL7C into the picture. Being quite familiar with the Wasatch Front, he soon was impressed enough with the expedition to volunteer his services as our much needed link.

Scott Nelson transmitting at 14,400 feet during the storm. (Photo by Bob Bonar)

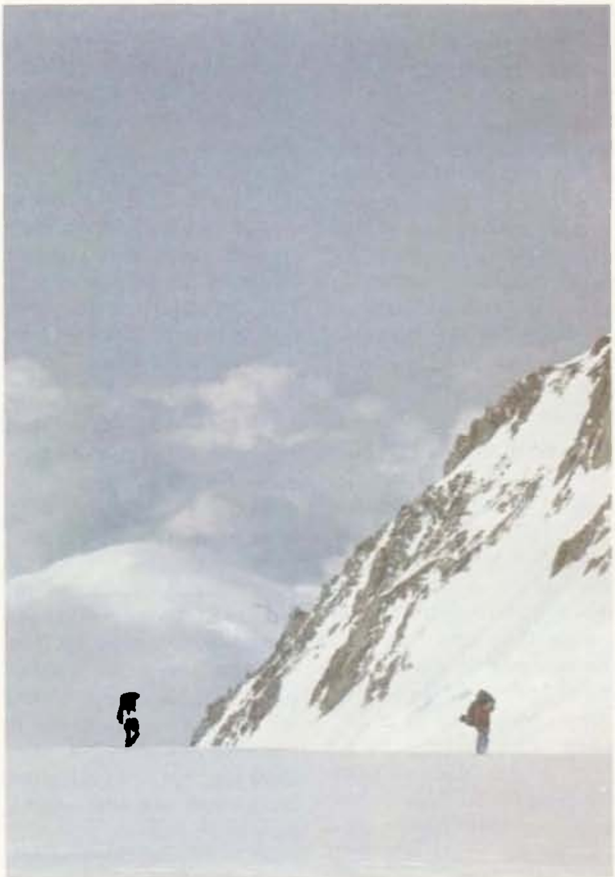
Ray, in turn, contacted Roy Davies KL7CUK in Montana Creek, about seventy-five miles from the mountain, who agreed to back us up with simplex coverage. Ray devised a direct-coupled patch while Roy relied on acoustic coupling (as simple as holding the mike to the speaker!). Russ Knodel KL7HC also came aboard as backup, and we were set!

After a shakedown climb on Mt. Rainier (following the same route where eleven climbers tragically lost their lives a month later), we were off to Anchorage, where, in addition to our sixty-pound packs, we divided over six hundred pounds of group gear that would be towed on sleds behind us. We would be using specially-equipped mountaineering skis on the lower glaciers, thereby eliminating the need to shuttle loads. All one hundred twenty pounds apiece would be carried in one trip until we reached the steeper sections where skis would be traded in for crampons.

The Anchorage-to-Talkeetna leg was on the Alaskan Railroad, a three-hour trip that occasionally yielded a glimpse of the distant mountain. Nearing Talkeetna, we could see ski-equipped planes heading north toward the glaciers where climbers would be dropped off.



Dr. Gernot Spalleck at 16,000 feet, at 2300 hours.



Climbers at 14,500 feet.

Soon it was our turn, and as we stuffed ourselves into the Cessna 185 among packs, sleds, and skis, the drama began. Our pilot, Cliff Hudson, climbed to 8000, and thirty minutes later entered One Shot Pass (no turning back!) and descended to the Northeast Fork of the Kahiltna Glacier (Kahiltna International, to the pilots) where we established base camp at 7000 feet. Here we were in the shadows of fourteen-thousand-foot Mt. Hunter and seventeen-thousand-foot Mt. Foraker. Several other expeditions were preparing to leave, so we decided on an overnight stay before setting out on our own the next morning, after organizing loads for the final time.

I was surprised to find that I could access the 90/30 machine in Anchorage from a spot near the airstrip. A check with KL7CUK confirmed our arrival, and a schedule was made for a week later when we expected to arrive at 14,400. Although I would try to access the repeater daily, I did not expect to be able to do so until clearing the shadow of the mountain and arriving at 14,400.

The climb from 7000 to 11,000 was a joy. We encountered only one snowstorm, and on several days climbed in shorts with no shirt. The sun was unbearable during the day, and at night the mercury often plummeted fifty or sixty degrees! We climbed anywhere from one thousand to fifteen hundred feet per day depending on the steepness, though generally it was moderate low-angle glacial terrain over a few steeper ice falls. Crevasses were mostly bridged with the winter's snowfall, though occasionally a gaping hole would open up beside the trail.

We roped together from the moment we left the airstrip, a move I was most thankful for on the day I suddenly plunged into a hidden crevasse. Luckily, the rope prevailed, and I didn't sink below the surface. We often joked about our turtle routine, something that occurs as you are trying to right yourself or get up after falling with the heavy pack strapped to your back. Sounds funny, but try it sometime!

After 11,000, the climb got more serious, for facing us was a pitch called "Motorcycle Hill." The sleds were cached with our skis at the base and we began one of several shuttle climbs with loads. The next camp was established at 12,500 just below a pass called "Windy Corner." We were anxious to reach 14,400, for there we plannned a few rest days before heading higher. Two loads to 12,500 in one day, and we were off the next day for 14,400. Windy Corner was anything but windy, but medium-angle blue ice proved to be a tricky traverse. With crampons and ice axes, however, we passed with no problems.

In camp that night a day early, I once again tried the repeater and got through. Ray and Roy were standing by as they had all week in case I managed to get into another hot spot. No one was on twenty meters from Salt Lake that evening, so, after a wrap-up of the week's activities, we signed off till the next evening when we would try to run some patches to Utah.

Returning to 12,500 feet the next morning, we loaded the balance of our supplies on our backs and were

off again around Windy Corner, which was still windless. At 1800, I was again able to get into the 90/30 repeater, and for the first time there were Al Wolff KC7O and Mike Mladevosky WA7ARK in Salt Lake City patched through from twenty meters. A few minutes later, Mike had my wife Suzi on the phone, and from twenty-five hundred miles away via two and twenty, I was able to report our progress.

The looks on the faces of the other climbers were of amazement as they heard me talking with Suzi and my son Tyler on what looked to them to be a simple walkie-talkie. Their only experience with radios till then had been with the sometimes-less-than-efficient Motorolas used by the ski patrol.

Following that first conversation, I had daily requests for message-handling from other members of our party, usually consisting of one-way phone calls from Anchorage. The pattern remained the same: the 1800 check-in on 90/30, with WA7ARK and KC7O standing by on twenty meters for either KL7C or KL7CUK.

I tried to limit the on time to fifteen minutes to conserve batteries, but by the time we got through with check-ins, messages, and weather reports, it usually ran more than thirty minutes. I came equipped with four sets of alkalines (24 AA batteries), but the cold weather was eating them up faster than I planned. The procedure was to take the unit out of my pack at 1700 and place it inside my down jacket for warmth. Some evenings this wouldn't be possible, or perhaps was possible for only ten or fifteen minutes. Mike always remarked on those evenings about the deterioration of my signal in both strength and quality. "Forgot to warm up tonight, didn't you, Scott?" became his standard greeting.

We ran both simplex and repeater patches with equally great results. Al taped all transmissions on cassette, and eventually they will be part of an audio/visual show I am planning on the climb. Suzi found it easier to hop into the car with Tyler and drive to either Mike's or Al's QTH than to rely on a phone patch across town. Undoubtedly, Tyler (2½ years old) enjoyed the excitement of adventure much more while sitting at (or on) Al's or Mike's bench.

If you have never spent three days in your sleeping bag waiting for the weather to clear, you haven't missed much. The evening radio call was the highlight of the day—except when the wind was whipping snow past you at forty miles per hour at −25° F. Five days after arriving at 14,400, it finally cleared and we prepared to climb to 16,000 feet. The previous day it had stopped snowing long enough for us to make a carry to 15,000, but now we were prepared to go up the most difficult section of the mountain.

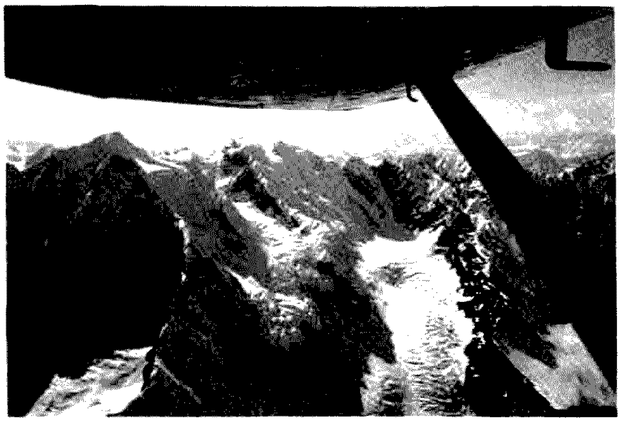
Suddenly, two French climbers came into camp asking if we had a doctor. A German climber camped near them had come down with pulmonary edema and urgently needed attention. After considerable discussion, Dr Spalleck predicted that the climber would be in a life-threatening condition if not treated immediately with the proper drugs and, most importantly, taken to a lower altitude.

At 1000 I put out a call again on 90/30, which also is the RACES repeater in Anchorage. Moments later, Roy KL7CUK was on frequency and mobile on his way to Talkeetna where there was both an FAA Flight Service Station and a Park Service Field Station. Arrangements were made for a Bell 206 to leave Anchorage, 150 miles away, refuel in Talkeetna, pick up a Ranger, and head on to McKinley where the morning's clear skies were rapidly deteriorating. The ceiling was still below us at 11,000 feet, but clouds now were forming in the high basin where we waited with the now-critical climber.

Dinner in a blizzard.

After probing the area for crevasses, a landing area was stomped out and flagged in the new snow. By now we were totally clouded in, and from Roy I learned that the rescue helicopter was approaching the mountain. Four hours had gone by since the first call went out, and now the

Rescue helicopter taking off.



Just past One Shot Pass.

The expedition's banner.

German's life depended on the helicopter getting in.

At the same time we first heard the chopper approaching, we also noticed a bit of blue sky, however, and by the time he arrived, the sky had opened enough for him to land on his first approach. While the downwash from the blades created a white-out with the new snow, the pilot never backed off on the pitch and hovered with the skids just touching the snow as several volunteers loaded the climber into the bird. He was off as quickly as he had arrived, with the clouds closing in as he disappeared from view.

What had begun as a novel experiment in backcountry communications had suddenly proved to be an invaluable contribution to saving a man's life. We returned to our camp and again made preparations to join the rest of our group, now more than two-thirds of the way to 16,000 feet.

Because of uncertain weather we dared not wait another day, so at 1600 we broke camp and started up the steepest section of the mountain. I hoped that the cold I had caught a few days before wouldn't affect my climbing, but by 15,000 feet, my breathing told me it had. At 2030 that evening, we dragged into camp to join the others, my lungs strained to the limit. I had told Roy earlier that I probably would miss that evening's call and had asked him to relay that information to Utah.

The next morning, my high-altitude headache persisted and a new storm was raging. Staying on an exposed ridge at 16,000, we decided to push on to 17,500 where we would be more sheltered from the storm. This was a relatively easy climb, but also the most beautiful in clear weather. Disappointed to miss the photo possibilities, we pushed on through the snow to high camp where my headache still bothered me.

That evening's call was next to impossible, for I had to climb an exposed ridge in order to hit the repeater, and in doing so opened myself up to the full fury of the storm. (Listening now to KC7O's tapes of that and the next evening's conversations, I can understand the alarm felt by those not on the mountain. My voice lacked clarity and enthusiasm, for the altitude was affecting me more than I realized. I remember hearing my little boy's voice and feeling very sad I was not with him and his mother.)

The next morning, the storm continued and we spent the day in our sleeping bags drinking soup and tea and playing cards. Still I felt no better, and by the second morning knew I would have to go back to 14,400 to re-acclimate myself if I wanted to reach the summit. I left at noon with several other climbers, and we reached our lower camp by late afternoon, where my headache immediately disappeared. I would have to spend at least twenty-four hours there before going back up, but the next morning we awoke to blue skies and knew that the others would be going for the summit. Not having the logistical support for two summit attempts, we all departed for base camp, knowing that the others would join us in a few days.

Disappointed, yes, but, as you quickly learn as a climber, summits are not everything. The climb to 17,500 feet had been the most exhilarating experience of my life and I could not regret a moment of it.

We arrived at base camp at 1945 that evening. With twenty-one hours of daylight and three hours of dusk every midsummer day, Alaskan pilots can fly nearly anytime the weather permits. Within an hour of the time our party was ready, Cliff Hudson was again landing his plane on the strip and we were hurriedly loading our gear and ourselves into his plane. With the weather closing in fast, Cliff elected to take us all out in one load and come back for the remainder of our gear when the weather cleared.

All the passes were socked in, and our only way out was to follow the Kahiltna for twenty or thirty miles to the toe of the glacier. After nearly three weeks, we saw green again, and a short while later were landing in Talkeetna. Cliff's son met us at the dirt strip with his pickup truck and, as we piled out of the plane, handed us each a cold beer. Sitting on the tailgate still in our climbing boots, gore-tex, and wool clothes and feeling slightly over-dressed for this warm summer evening, our conversation drifted to our next adventure. What would it be . . . South America next summer, or maybe Nepal and the Himalaya? I'd have to check the repeater directory on those two. Meanwhile, having finished our beers, we headed into town for a typical American meal: hamburgers and french fries. After three weeks of instant mashed potato mush and eggs, it tasted like a steak dinner.

Cliff was sitting there with us, a cigarette hanging out of the corner of his mouth. Taking a deep breath he said, "There now, how do you like breathing some of this heavy air for a change?"

Heavy air, indeed! ■

Reader Service for facing page ✓451→

Chuck Zappala WA7VZR
8051 NE 143rd Street
Bothell WA 98011

The Simplex Autopatch

—a telephone interface for everyone's two-meter rig!

Several local hams have been talking about a different kind of VHF autopatch that uses one frequency. This discussion has been going on from time to time over the past few years. We have designed many paper models of such a machine, with nothing more than a few beers as inspiration. But, in the August, 1978, issue of *73 Magazine*, there was a report of a machine built by John Walker WA6MHF in southern California. Well, needless to say, this sparked the discussion again, which this time actually led to construction.

For those of you who don't know what a single-frequency autopatch machine is or how one basically works, read on. Since most readers know what a traditional autopatch repeater is, let's start by explaining that it uses two frequencies (an input and an output), a duplexer (or similar device), and some control circuitry. Once the autopatch repeater is accessed, the transmitter is always transmitting and the receiver is always listening. Thus, two frequencies are used at all times.

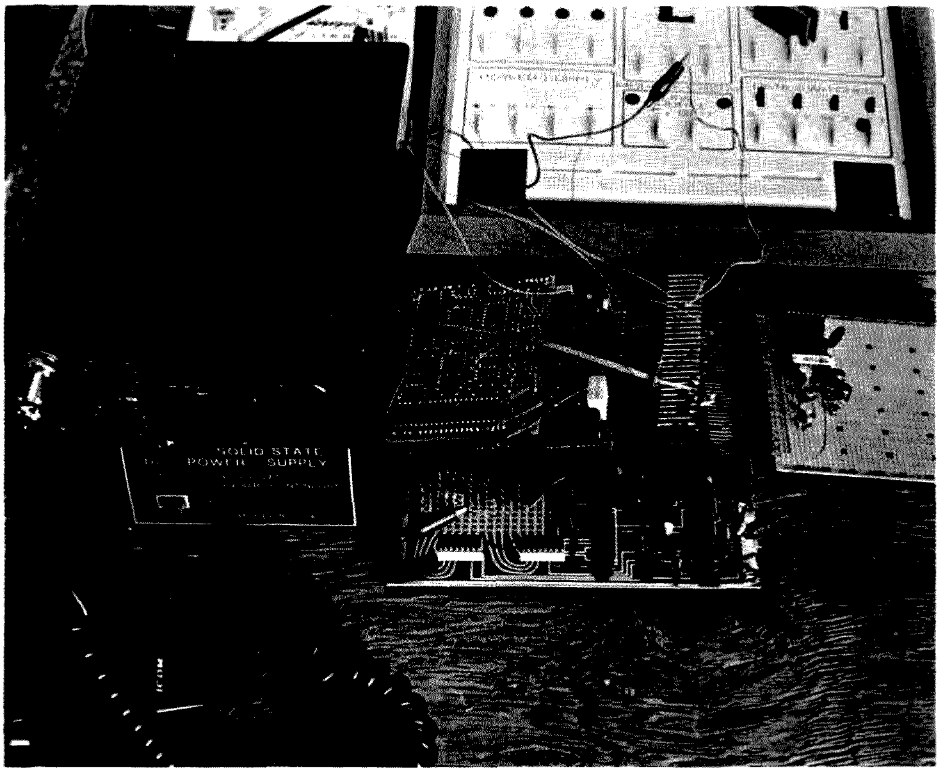


Fig. 1. Complete hardware for simplex autopatch.

Using this method generally requires a duplexer to provide rf isolation between the repeater's transmitter and receiver circuits, in order to use one antenna.

The control circuitry provides the means to access the phone line, limits the length of the call, and terminates the patch.

The simplex method uses a single frequency, does not need a duplexer (unless you are in a *very* high rf environment), and requires slightly different control circuitry. The receiver is always listening on the simplex channel. When a signal is received and the appropriate tone command is received from the user, both the ON DIGIT and COR LINE enable a circuit to connect

the phone line to the receiver and transmitter. At the same time, the transmitter is keyed on for 1.3 seconds and then off (in the receive mode) for about 40 milliseconds. What the user hears is dial tone from the phone line that is interrupted by "clicks" or the receive window. The user then keys his transmitter, and in less than 1.3 seconds (the time until the next receive window), the patch receiver will detect his signal (COR LINE) and inhibit the transmitter. The patch receiver is now locked in, listening to the user. The user then transmits his touchtone™ signals through the patch receiver to the phone line and on to the central office.

Local patch-control circuitry should check for local calling only and the length of the patch and dump the call if calling criteria are not met. Since this is not the purpose of this article, I will not go any further. When the user releases his transmitter button, the patch receiver responds by enabling the patch transmitter again in the same way as described previously. Thus the user can hear his call being processed (the called party's phone ringing and being answered). The user may talk to his party in a normal push-to-talk mode with the exception of the 1.3-second maximum delay and the "clicking."

Disconnecting the patch is simply a matter of the user keying his transmitter, pausing for the receive window, and signaling the disconnect code. The OFF DIGIT code also disables the patch transmitter from keying and locks the patch receiver in the receive mode.

The disadvantages to this method of autopatching are the "clicks" and the delay in speaking to your called party. The "clicks" are somewhat distracting to some and are quite tolerable by others. I found that with increasing use you can get used to the "clicking," and after experimentation, about 1.3 seconds was about the right speed to sample for a user's signal. Of course, you can set the speed to just about anything you feel is right, within reason. For example, trying to make the "click" shorter by narrowing the receive window less than 40 milliseconds depends on your transmitter-receiver switching time. Obviously, you should use a crystal-controlled receiver (synthesized receivers are much too slow, about 140 milliseconds). Also, the same applies for the transmitter as well. Another point is the method used to switch the antenna from receiver to transmitter. Relays are also much too slow because they add to the total switching transition. Rf detecting (diode switching) in the newer VHF radios works very well.

The advantages are cost, simplicity, portability, and frequency conservation. Since there are no duplexers or similar rf plumbing, you save about $350 to $400. You don't need an expensive VHF radio such as a Motorola Micor (which a good repeater would use and costs over $1000). I used an Icom IC-22A, which was purchased used for less than $200. The modifications amounted to tapping the audio, the COR line, and the transmitter key. Later, I removed a 22-microfarad capacitor from the squelch dc amplifier to speed up the switching time. There are other modifications that could be made to improve the switching time, but I decided to study the present design before making any more changes. Since the VHF radio is small and can be run from a battery and there is no rf plumbing, the machine is very portable and has good emergency communications potential.

All you need is a phone line, a quarter-wave whip antenna, and a single channel assignment.

The photograph shows the second breadboard version of the machine. The first version was a real rat's nest. Come to think of it, the second version has just as many wires going in every direction, but it works quite well. Ken Koster WA7RYP is one of the locals who worked on this project with me. Ken was eager to supply some vital circuits as well as his experience to make this machine work. Ken loaned me his Teltone™ M-907 touchtone decoder from his 450-MHz repeater. The decoder is about 4 inches long and 3 inches wide. It uses opera-

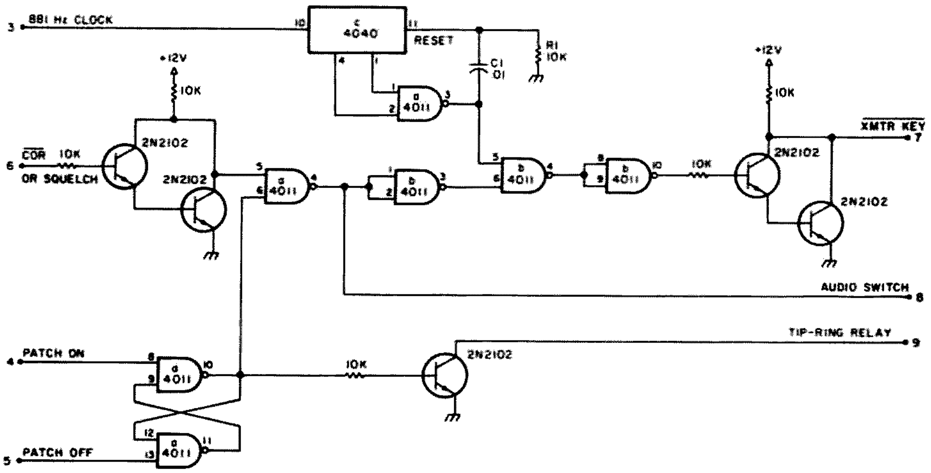


Fig. 2. Interface logic circuit.

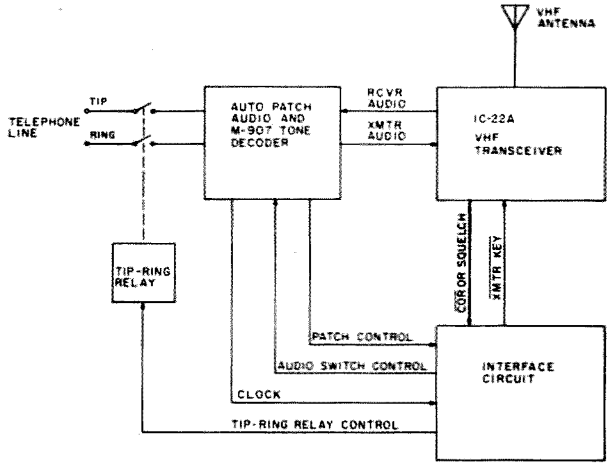


Fig. 3. Block diagram.

tional amplifiers for tone conditioning and a 40-pin LSI for tone verification, timing, digit output, and other functions. The decoder has an 881-Hz clock output which we used as a timebase to the control circuit for switching the transmitter and receiver. The unit costs about $85 and it mounts on another one of Ken's boards piggy-back style. Ken's main board also contains the autopatch audio and telephone interface circuitry. This circuitry is shown in the photograph in front of the Heathkit Digital Designer which contains the interface and control logic for the IC-22A.

After a few hours of blitz building, we had the second version ready for on-the-air tests. Using a Wilson Mark IV with a tone pad, Ken punched up the access, got the dial tone, punched up the local number, and there she was . . . the good ol' time lady. We dialed up a few ham friends for reports and made a few adjustments to the audio levels at the same time.

Later on that evening, Ken and I were talking simplex on the machine's VHF channel. I got this wild idea to call our friend Dave Miller WB5WCG in New Mexico! Ken topped it by suggesting that he dial the number from his location about 5 miles away. So I disabled the long-distance dump circuit and Ken started to dial Dave. A few seconds later, Dave was talking to Ken about our effort. A few short years ago, Dave was a local ham who was participating in our efforts for a single-frequency machine. Actually, he was surprised we finally did it. He knows that we dream a lot and that our fantasies seldom turn into connected silicon chips. During this live on-the-air conversation, Dave was giving his call and identifying the machine. The call lasted just a few short minutes, but when it was over, several hams who were listening in started calling the DX in New Mexico!

The schematic of the interface logic is shown in Fig. 2. An 881-Hz clock signal from the M-907 is used to clock a CMOS 4040 (a divide-by-4096 chip). The 4040 is configured to provide a receive window pulse every 1.3 seconds. By referring to a data book, you can easily change the sample rate and receive window pulse width. The output of the 4040 is NANDed and used to reset itself (the 4040). The value of R1 and C1 are not very critical. The 4011 latch gates the output of the COR Darlington transistor pair to allow the COR line to control the output of the 4040. The COR LINE and the 4011 latch control the transmitter keying line by using some 4011 NAND gates. A few transistors are used for the receiver COR and key line. The resistor values of these circuits are not very critical either. The transistor Darlington circuits may require some changes for the specific radio they are to interface. Fig. 3 illustrates a block diagram of the machine. The audio circuits interface the radio to the phone line and the tone decoder.

Remember, this machine is not a repeater and cannot be used to contact another ham via a downlink radio path. The machine can only transmit what it hears from the phone line and send to the phone line what the patch receiver hears. I would be interested in hearing from anyone who knows about any similar efforts or any improvements. Please, SASE letters only. ■

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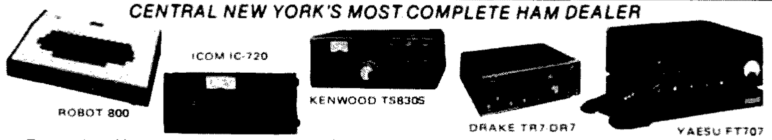

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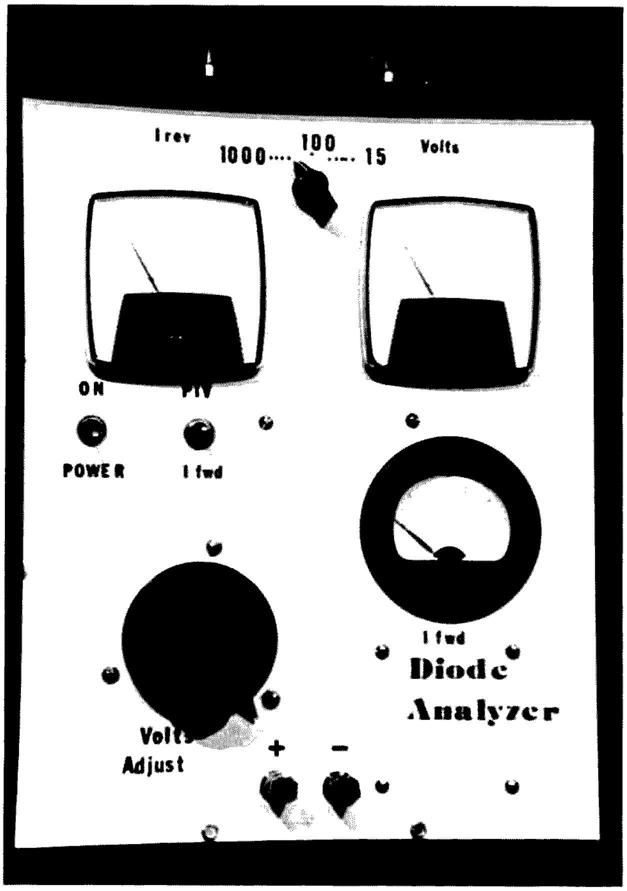
The Cheapskate
—a checker for bargain diodes

With a mighty hum and a cloud of smoke, another power supply bites the dust! Sound familiar? If it does and if you roll your own as I do, the diode analyzer discussed here will help save your projects by preventing unworthy diodes from creeping into an otherwise good job.

After a few of my bargain diodes turned out not to be bargains, even after checking them on a "diode tester," I decided to build a tester that would check the actual prv and forward voltage drop of a diode and to do it with as little cash outlay as possible.



Front panel of the diode analyzer.

The Cheapskate analyzer will provide you with the information you need when selecting or grading bargain-pack diodes. The culls can be used for noncritical applications, one-way wires, etc. And, the good ones can be graded for performance at whatever voltage or current levels are required by the circuit they are to be used in. It requires *no* external meters or connections other than to the diode under test.

Experience has taught me that test jigs and alligator clip leads with 1000 volts or so on them can be an unhappy combination if one gets careless or is in a hurry. This is the reason for the all-in-one-box design.

This device will allow you to test diodes under actual anticipated operating voltages or currents and to match diodes for HV rectifier strings or other purposes.

This article is not a step-by-step, how-to-make it type for the simple reason of economics. It does not make sense to build an expensive device to test bargain semiconductors. Although once built, I would recommend testing any diode that you intend to use, even so-called first-quality ones, as it will prevent some nasty surprises.

The tester (Fig. 1) consists of two variable-voltage supplies and their associated metering and switching circuits.

VT1 is a 0-to-130-volt Variac; a 50-Watt rheostat could be used instead. The idea is to vary the input voltage, so whichever means your scrounging or junk box provides will work.

R1, R2, and R* are limiting resistors and limit the voltage out of the prv test section to agree with the meter scale in use. In my case, this meter (M2) was a 50-μA unit with scales of 100, 15, and 3. So, I set R1, R2, and R* and R4, R5, and R6 for full-scale readings of 1000, 100, and 15 volts at maximum setting of VT1. The meter that you use in your voltmeter circuit will determine the values for these resistors. I would recommend a meter with a 50- or 100-μA movement as best suited for this application. The meters that you have available will depend on the size of your junk box or what's on sale at the local hamfest.

As high-current dc meters are not cheap—even

used—the best bet is to use a shunt. My favorite is a 0.001-Ohm shunt used with a 50-μA meter. The shunt is either 11-7/8" of #10 solid copper wire or 7-7/16" of #12 solid copper wire. The series resistor value will depend on the internal resistance of the meter and the desired range of the meter. Just divide the full-scale reading of meter in volts by the current in Amps needed for full-scale deflection. Then subtract the internal resistance of the meter used to find the series resistor value (e.g., 0.025 volts full-scale and 25 Amps. 0.025 V/0.00005 A = 500 Ohms − 300-Ohm meter resistance = 200-Ohm series resistor). For other ranges, remember that the voltage drop for the 0.001-Ohm shunt will be 0.001 volt per Amp of current through the shunt. Use #10 wire for 30 to 50 Amps.

When measuring the internal resistance of meters with sensitive movements, use a series resistor of known value to prevent exceeding the range of the meter under test.

Transformer T1 is a small unit of unknown origin that provides approximately 1000 V ac to D1 and D2, which are 1-kV, 1-Amp units. C1 and C2 are 1-μF 600-volt paper caps. A 1- or 2-μF, 2-kV oil-filled unit would be perfect here but will have to wait until the next hamfest. Do not use a string of high-capacity electrolytics here as it will strain T1 and take quite a time to discharge. M1 is a 50-μA meter from the same junked unit as M2. The meter scale here is unimportant. All that is necessary is to indicate when a few microamps of current begin to flow in order to establish checkpoints when matching diodes.

T1 can be any type of small transformer capable of delivering whatever maximum prv you wish to check. Since current drain is very small, the smaller T1 is physically, the easier it will be to package. R3 is a limiting resistor and should be high enough to limit the shorted output to around 100 μA at T1's maximum output. (Yes, Waldo, diodes do come as dead shorts occasionally and some of us can't guess which end of an unmarked unit is the cathode every time.)

T2 is a 2.5-volt, 10-Amp filament transformer to provide current for the I_{fwd} (forward-voltage drop) test. T2 could be a 5-volt winding on T1. However, I wanted to test high-current rectifiers so I used what I had available. D3 is a 50-volt, 25-Amp stud-mount diode. C3 is 10 μF at 30 volts and M3 is a 5-Amp unit. R7 gives me a full-scale reading of 3 volts on M2.

S3 is a rotary switch. It could easily be a DP3T slide switch if it can handle the necessary voltage. S2 is a DPDT center-off toggle switch, and if you buy only one part this should be it. It should be rated for whatever I_{fwd} you are designing for, and the center-off position is necessary for safety when using the unit. As a matter of fact, a momentary switch is not a bad idea even though operation would then be two-handed.

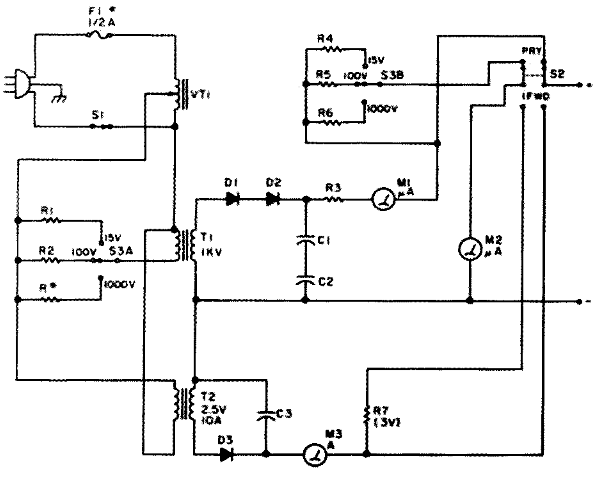


Fig. 1. The diode analyzer schematic diagram.

Construction Hints

1) Do not rush to your local parts house and buy all the parts. First, it would be expensive (the 2-Amp Variac is around $20 to $30) and, second, you will not have the opportunity for a good scrounging session.

2) Do not use chassis ground; use a ground bus instead. This will help prevent shocks.

3) Use a large container so that you will have room for future modifications and additions.

4) Group control functions in a logical arrangement.

Operation

For prv test, install a diode (cathode to positive), set volts adjust to minimum, set to lowest prv range, set range switch S2 to prv, turn on power, and advance volts adjust. If M1 goes off scale, reverse the diode connections and try again, advancing volts adjust and S2 range switch until a point is found where a very rapid increase in current occurs for a very small increase in voltage. This is the breakdown or zener point for the diode under test. The voltage, at the breakdown point, is the prv of the diode. Rate the diode well under the actual prv, especially in power-supply circuits.

If the diode under test shows a steady rise in current for an increase in voltage, discard it or use it in a noncritical use. It will become very apparent after testing your first handful of bargain diodes why they were priced so low.

For testing the forward-voltage drop (I_{fwd} test), turn off power, reverse the diode connections (cathode to negative), set volts adjust to minimum, switch to I_{fwd}, turn on power, and advance volts adjust until M3 indicates proper I_{fwd} for the diode under test. M2 will show the voltage drop across the diode. For a good silicon diode, this will be 0.4 to 0.8 volts, depending on the temperature and specific type of diode. Remember that the diode will be dissipating I × V power, so don't take too long for this test. It is possible to destroy the diode rather quickly.

If you test zener diodes, remember that the current will be limited by R3 to a very low value. However, the zener point will show up very clearly because M2 will rise to the zener voltage and refuse to go higher with an increase in the setting of volts adjust. M1 may go off scale under these conditions, so if you test zeners often, a shunt and switch could be added or a separate circuit could be added for testing zeners only.

This project has been well worth the time spent in construction and design. It provides a very worthwhile addition to my bench and has provided an extra bonus in that I use it as a source of low-current voltage and for checking leakage of unmarked capacitors. Last, but not least, I now know that when I install a diode in a project that its specs will meet the requirements of the circuit in which it is installed.■

John M. Franke WA4WDL
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Norfolk VA 23508

Constant Current from a Voltage Regulator

Ever needed a constant-current supply? Recently, I needed a constant-current source to test some incandescent lamps as radio-frequency broadband noise generators. Rather than design an elaborate circuit, I decided to try using a simple technique by which a constant-voltage regulator can supply a constant current.

If a fixed resistor is placed across the output of a three-terminal voltage regulator, the current drawn from the supply is independent of the supply voltage. Hence, if the regulator circuit with fixed load is placed in series with any device, the current through the device will be constant and equal to the regulator output voltage divided by the fixed load resistance. The circuit configuration is shown in Fig. 1.

The output current is set by R1. For a 5-volt regulator, the output current is: $I = 5/R1$.

The maximum output current cannot exceed the regulator's output current rating. Hence, with a standard 7805 or LM309K, R1 should not be smaller than 5 Ohms. The power dissipated by R1 is 25/R1. The wattage rating of the resistor should be at least twice this value. The voltage drop across the regulator is the supply voltage minus the load voltage and must not be permitted to fall below 7 volts. The supply voltage must therefore be greater than 7 volts plus the load voltage or: $V_S \geqslant 7 + R_L I_{reg}$.

If the difference between the supply and load voltages drops to less than 7 volts, the current will no longer be constant but will decrease. This can be seen in Fig. 2, where the output current as a function of supply voltage for different load resistances is plotted.

One caution: Do not let the supply voltage exceed the input voltage rating of the regulator chip, which is usually 35 volts. Since I first tried this technique, the circuit also has been used to stabilize the current to a CW laser diode system where I work. ■

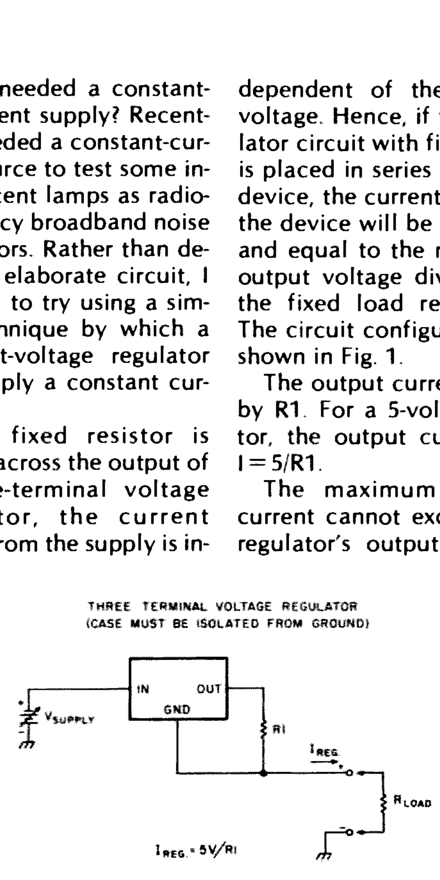

Fig. 1.

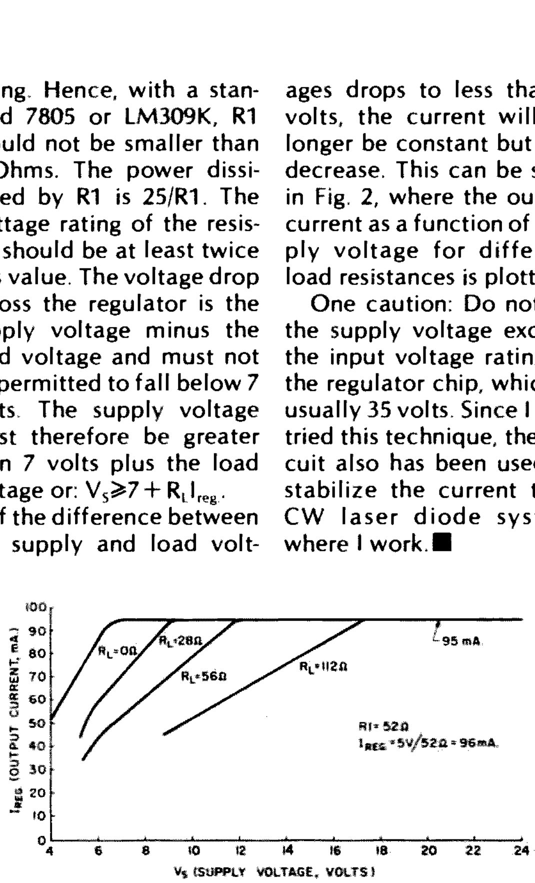

Fig. 2

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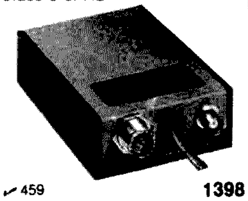

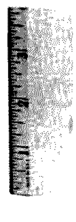

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The Hesitator: A Windshield Wiper Control

—a rainy day project

This article is for the amateur who wants to make an inexpensive electronic device, using an integrated circuit, for his own pleasure or as a gift to a friend or friends. It is a hesitation circuit for your automobile windshield wiper and will cause delays of 2 seconds up to 15 seconds in the repetition cycle of the windshield wiper. It's great for misty or very light rainfalls.

It was mounted in a small box, fitted behind the instrument panel, and mounted by the potentiometer-securing nut. The wiring changes require the cutting of one wire in the wiper motor circuit and the soldering of ground and 12-volt power leads. I've built three for my friends and one for myself; they work great.

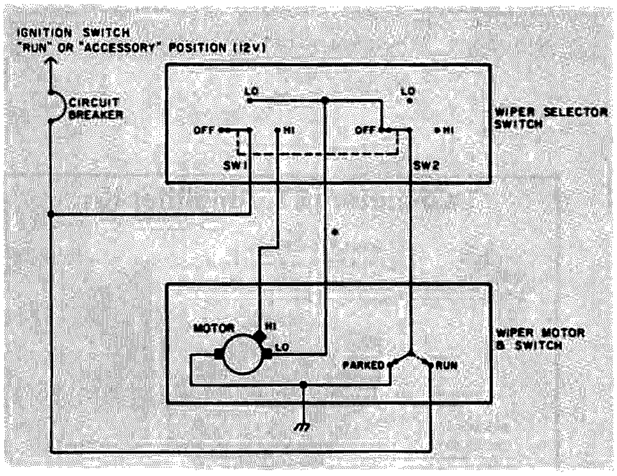

*Fig. 1. Automobile wiring circuit of windshield wiper control. The * indicates the point at which the hesitation control unit is installed.*

Automobile Wiring

The standard wiring for an automobile windshield wiper circuit is shown in Fig. 1. To understand the simplicity of the required wiring changes, let's go through the circuit. The ignition switch is in engine run or accessory position. To make the wiper motor run, it is necessary to have a complete circuit from 12 volts to the motor and then to ground. Notice that two switches are involved: the wiper selector switch, which permits selecting a low-speed, high-speed, or off position, and a wiper motor switch with parked and run positions.

In the off position of the wiper selector switch and parked position of the wiper motor switch, 12 volts cannot be supplied to the wiper motor.

If the wiper selector switch is turned to LO, 12 volts is supplied to the LO connection of the motor, then to ground, and the wiper motor moves the windshield wiper across the face of the windshield. When the selector switch is turned to HI, 12 volts is connected to the HI winding of the motor, which moves the windshield wiper at the higher speed.

Anytime the motor is running, it actuates an SPDT switch that alternately moves from ground to 12 volts. The ground position is known as the parked position and the 12-volt position as the run position. The run position takes up approximately 95% of the total time for one cycle of movement of the wiper.

When the wiper selector switch is moved to the OFF position, 12 volts is no longer applied to the motor from the SW1 contacts. If, as is the usual case, the wiper blades are not in the nest-

ed position at turn-off time, the wiper motor switch will be in the run position. While in this position, 12 volts will be connected through the switch, through the OFF position SW2 contacts of the wiper selector switch, and to the LO winding of the motor. The motor will continue to run until the motor switch is automatically moved to the parked position. At that time, voltage is no longer applied to the motor, and the wiper blades stop at their nested position.

To put in a hesitation control circuit, it is necessary to break and insert such a control at the point shown in Fig. 1. (See the asterisk.)

Fig. 2 shows the insertion of the control unit, which essentially is an SPDT switch contact operated by a relay, at that point.

In the unenergized condition of the relay, as shown, the contacts look like a straight-through connection, and the wiper selector switch is in control as already explained. (Keep the wiper selector switch in the OFF position.) When we momentarily (1/2 second, or so) switch the control unit contacts to 12 volts manually, the wiper motor will run and move the wiper motor switch to the run position. The wiper blades will make one complete cycle and return to the nested position. Power to complete the cycle is from 12 volts, through the wiper motor switch run position, the OFF position of wiper selector switch SW2, through the unenergized position of the control unit switch, and to the wiper motor. The motor stops when the wiper motor switch goes to the parked position.

All we have to do to make a hesitation controller is to devise a periodic short-term on-condition of its output so as to momentarily connect the LO motor lead to 12 volts to get it into a run/park cycle and to vary the time delay between repeating cycles.

Hesitation Control Unit

The hesitation control unit is designed around the faithful 555 timer. I learned how to use the timer from references 1, 2, 3, and 4. I know that there are a lot more articles on 555 applications, but these were enough.

Fig. 3 shows the schematic of the circuit used with the 555 timer in the astable, or oscillatory, mode. Two diodes in the timing circuit, CR1 and CR2, are used to select the charge and discharge times independent of each other's time constant.

Assume that the timing capacitor, C1, is charging towards 12 volts through CR1 and R1. The timer output (pin 3) will be high, and the length of time it is high is a function of R1 and C1. With the values shown, it is about 1/2 second. When C1 charges to the threshold trip level of the timer, both pin 3 and pin 7 go low. Then timing capacitor C1 will discharge to ground (pin 7) through CR2, R2, and R3. The length of time the timer is off is a function of the values of C1, R2, and R3. R3 is a potentiometer which is varied to control the amount of "hesitation" of the output. In the design shown, it is approximately 2 to 15 seconds. R2 is used to provide a minimum time delay when R3 is at its zero Ohms position.

As soon as the capacitor discharges to the lower trip level of the 555, pin 3 again goes high, completing the cycle. This oscillation continues as long as power is applied to the circuit.

For those who might want to change the above times: charge time = .67C1R1; discharge time = .67(R2 + R3)C1, where C is in farads and R is in Ohms.

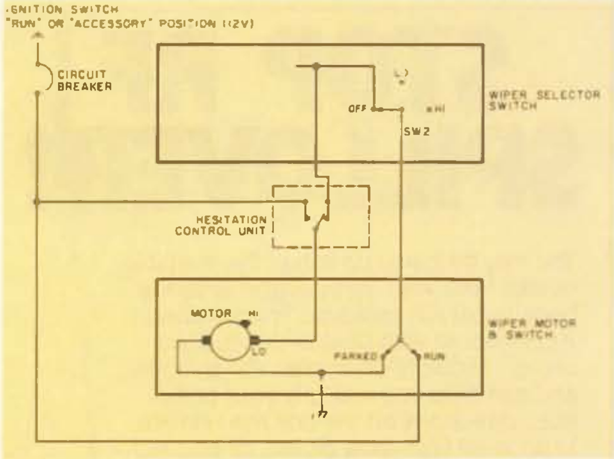

Fig. 2. Windshield wiper control with hesitation control unit added.

Because the relay which pin 3 drives is an inductive load, protective diodes are required to prevent the inductive kick at turn-off from latching or otherwise damaging the output of the timer.

Construction

Construction of the control unit was made as simple and inexpensive as possible. A chassis box 2-3/4" × 2-1/8" × 1-5/8" was used. Prepunched perfboard with holes spaced on a 0.1" × 0.1" grid measuring 1-3/8" × 1-7/8" was used as the mounting board for all components except the relay and its two diodes. The board was selected to permit an 8-pin IC socket to be used for the 555. The board was mounted on the back of the switch/potentiometer by drilling two holes in the board to clear the switch lugs. Using #16 solid wire to the lugs was sufficient to hold the board securely to the potentiometer/switch combination. Point-to-point wiring was used for the components.

The relay used is of the plastic-cased type. It was mounted to the box by removing its plastic cover and drilling a hole in the top of it to pass a #6 machine screw. The screw must be a flat-head type, with the head on the inside of the plastic cover. Use of a flat-head screw provides suffi-

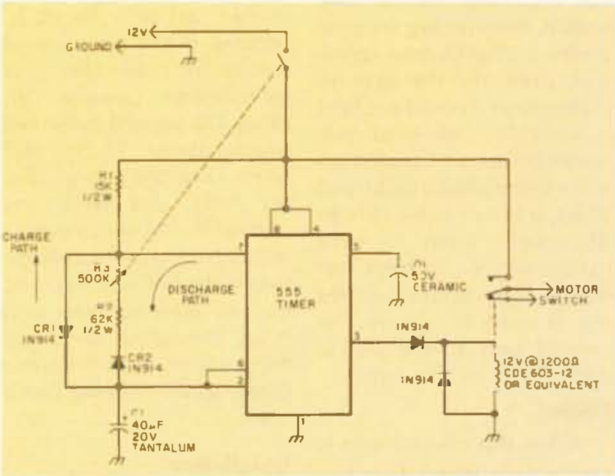

Fig. 3. Windshield wiper hesitation control schematic.

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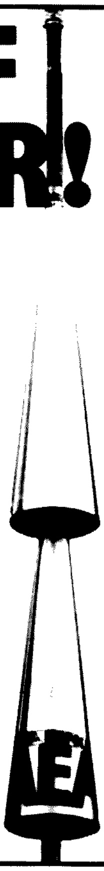

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cient clearance between the relay and the screw head. When the cover is reassembled with the relay, the whole thing is mounted on the side of the chassis box with an external nut.

Four connections are required between the control unit and the automobile: 12 volts, ground, motor, and switch. A solder lug secured under a chassis box screw was used for the ground connection. I could not find a suitable three-post terminal board, so I ended up using three phono jacks and plugs; it is nice to be able to disconnect leads in case maintenance is ever required. The potentiometer nut is used to secure the control unit to the instrument panel of the vehicle.

Testing

When the control unit is completely wired, check it with an ohmmeter between the positive power connection and ground to ensure that there are no shorts. Then connect 12 volts and ground to the proper leads, as well as a voltmeter between ground and the "motor" lead of the unit. Turn on the switch. The voltmeters should indicate an initial 12-volt reading, as C1 begins to charge, but it should last only about 1/2 second. If the potentiometer is left in the just-switched-on position, another 1/2-second pulse will occur about 15 seconds later. Turn the potentiometer fully clockwise, and pulses should occur every 2 seconds. Pulse pauses between the pot limits will occur at intermediate positions, providing an adjustment range to suit various damp to wet driving conditions.

Installation

The wiper motor usually is mounted on the engine side of the fire wall and on the driver's side of the car. To help locate it, try this: With the car engine off and the ignition switch in the accessory or run position, actuate the wipers. By feeling the running wiper motor, you can verify the fact you found it from the vibration on your hand.

It is necessary to identify two leads on the motor (there are usually four): the low-voltage lead and the 12-volt lead.

Most cars have a connector and plug at the motor; disconnect them. If there is no disconnect, the insulation of the leads will have to be cut to make voltmeter connections. With the ignition switch on and the wiper selector switch off, determine which of the four leads has 12 volts on it. That is the lead to the "run" connection of the wiper motor switch. It is always hot (12 volts) when the ignition is on and will be used to power the control unit.

Next, with the wiper selector switch in the low-speed position, determine which additional lead now has 12 volts on it. This is the lead which must be cut.

Now find a suitable mounting place for the control unit on the instrument panel. A 3/8"-diameter hole (or one to match the shaft of the pot you used) is drilled in the panel and the control unit secured by the nut on the potentiometer.

In addition, a hole through the fire wall must be found to pass the four wires connecting the control unit to the wiper motor. In some cars, a spare blank rubber grommet may be used by drilling a hole through it for the cable. In other cars, a large existing grommet may be drilled to pass the additional wires. If a new hole must be drilled, use a rubber grommet to provide a tight fit around the wires to prevent engine fumes from getting into the interior of the car.

Determine the wire length needed to go from the control unit to the wiper motor and pass them through the fire wall. Cut the low-speed motor wire and put solderless quick-disconnects on the two separated wires, as well as the two mating wires in the cable. The wire still connected to the motor goes to the "motor" lead of the control unit. The other cut wire is designated as "switch" and goes to that label on the control unit. The ground lead from the control unit is connected (or better, soldered) to a lug placed under a grounded screw on the motor.

The insulation of the hot wire (12 volts) must be removed over a 1/2", or so, length, and the 12-volt lead from the control unit soldered to it. Tape all leads and secure the cable in some manner so that it will not vibrate excessively. Cut off the excess length of the potentiometer shaft and put a nice knob on it. Now you can enjoy driving in a misty or slight rainfall instead of fiddling with the wiper switch. The adjustable wiper rate will keep the windshield clear without needless use of your wipers. You also will have the satisfaction that as an amateur you can make something "practical" to use or to give to your nontechnical friends. ■

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4. *TTL Cookbook*, Don Lancaster, pp. 171-175.

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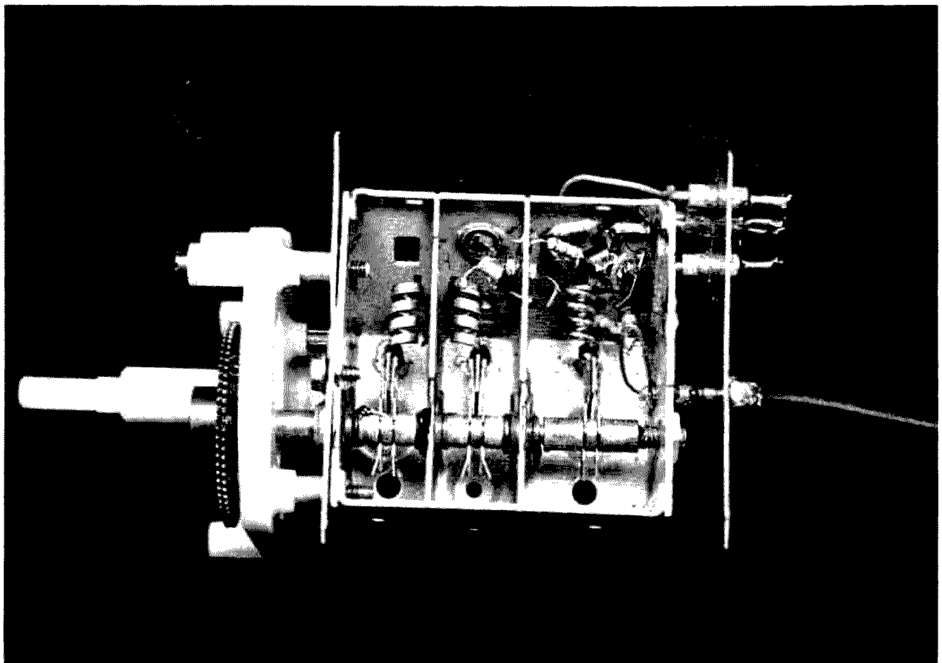

Photo A. Modified oscillator with front and back shields mounted. Bypass capacitors are mounted, and the brass ferrule passes the coax through the shield and the wall of the oscillator. Rf pickup loop can be seen.

In order to do any experimental work at UHF or microwave frequencies for amateur or TVRO projects, certain minimum equipment immediately becomes necessary. The first requirement for this work is to be able to generate known signals at these frequencies, to modulate, and to detect them. The use of microwave equipment from flea markets is not satisfactory because of its limited availability and its cost, and because relatively few units cover the frequency range of interest (500 MHz to 4 GHz).

The solution for the equipment problem turns out to be easy and inexpensive, with almost no debug problems. It consists of a modified UHF TV-tuner oscillator section followed by an harmonic generator. A sensitive detector is necessary for the low-power lev-

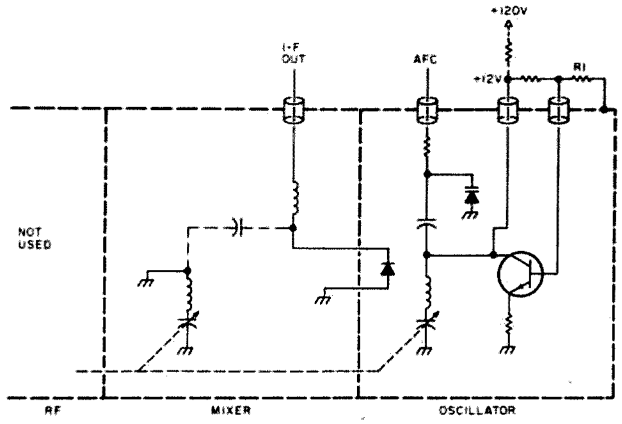

Fig. 1. Typical schematic of oscillator and mixer sections of UHF converters. Power supply is either 12 volts or 120 volts through a dropping resistor. The afc circuit can be used for frequency modulation or fine tuning, and the detector diode is used to monitor relative power output.

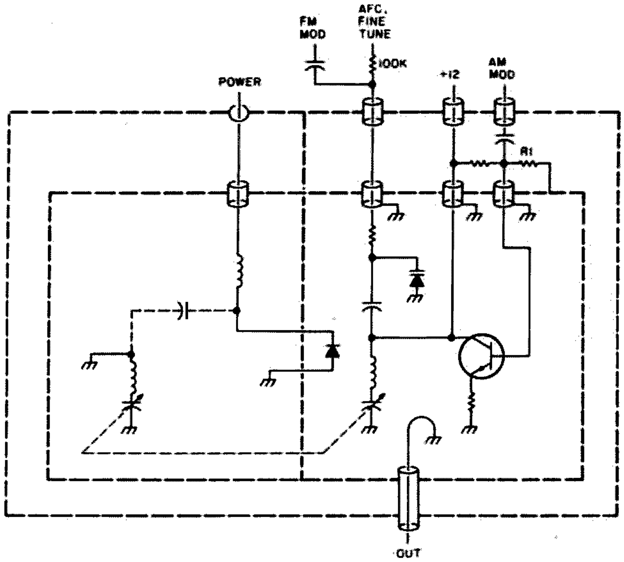

Fig. 2. Modified and shielded converter as used for a signal generator.

els involved, and this is easily found with a simple variable attenuator. The result is a signal source covering 525 MHz to 4.5 GHz with AM and FM modulation and video modulation on the low frequencies (525 to 1300 MHz), low level detection down to one microvolt, and afc or electronic tuning potential.

The construction requires only hand tools. The four basic units are modular and are reasonable weekend projects once the components have been obtained. Some general UHF techniques are outlined below which may be applied to make similar equipment more efficient.

Power-output monitoring on the fundamental frequency and a simple frequency calibration method also are described below, giving accuracy to about 1% without using a counter.

Generator

The generator consists of a modified oscillator section from a continuous-tuning type UHF TV converter. These are being sold surplus or may be recovered from an old TV set. One of the better units tested was salvaged from a 10-year-old TV set.

These units typically have the oscillator on the high side of the range, 45 MHz above the channel frequency, and cover about 520 to 930 MHz. Fig. 1 shows a typical circuit for the oscillator and mixer portions of the units. The design is simple, with minimum components for unwanted resonances, resulting in stable units. Some of the older units were found to have bimetal temperature-compensating elements. Otherwise, they nearly all have varactor diodes for afc frequency locking as shown in Fig. 1. The types with an afc diode provide easy FM capability and are the ones to use. All of the samples tested had good output which was relatively uniform over the band, dropping 3 dB at the high end. The two-speed vernier-dial mechanisms obviously help tuning.

The diode-mixer circuit coupled into the oscillator is used to check oscillation and output. It does absorb some power and may be cut out if not needed. The first section rf tuning closest to the shaft is disabled to minimize coupling rf out of the enclosure. Verify that the detector diode is all right by checking resistance at the phono-style connector. Forward resistance should be about 100 Ohms to ground. A 200-microampere-to-one-milliampere meter will read the output current.

Remove the cover of the tuner and by inspection find the voltage input terminal, the afc terminal, and, if accessible, the base bias terminal. Some units operate as grounded base oscillators, and the base is connected to a feedthrough capacitor with the bias network outside the case.

Power may be supplied in two ways, either through a 12k-to-15k, 2-Watt resistor limiting the current to about 10 mA, or directly from low voltage. The case is negative. A 12-V supply is used, and all units tested have oscillated, but the bias may have to be adjusted for uniform output and good modulation.

Use a series resistor of 2.7k to 3.3k to limit the current for an initial test of the oscillation with a 12-V supply. Current should be about 3 to 4 mA. The mixer-diode connection should show some current with the tuning capacitor fully meshed. A few microamperes indicate oscillation. If there is no output, increase the supply to 15 or 20 volts maximum for a test. If the detector diode is open, an rf probe can be made with a type 1N914 diode mounted directly on the terminals of a 50-to-100-microampere meter. Carefully probe the oscillator cavity for a reading. When oscillating with the cover removed, the signal should blank a UHF TV set at 10 to 15 feet without an antenna.

After the circuit is oscillating, remove the series-limiting resistor, apply 12 volts, and check for a reasonable and uniform output across the whole tuning range. Diode-mixer current should range from about 30 microamperes at the low-frequency end to perhaps 10 microamperes at the high end of the tuning range. Some oscillators have output as high as 100 microamperes. There should be no dead spots, with good output at the high end.

One oscillator with no high-end output was found to be biased incorrectly. It was discovered by af-modulating the transistor base through a small capacitor and observing the rectified waveform with an oscillo-

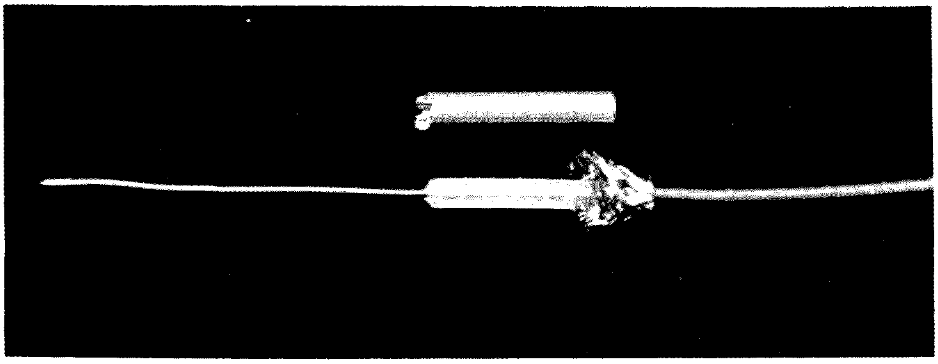

Photo B. Coaxial coupling cable and mounting ferrule before assembly.

scope. The modulating sine wave was badly clipped. To correct this, a variable resistor was substituted for R1 (Fig. 1) and adjusted for a good sine-wave output at low modulation level. A fixed resistor was then substituted for the variable. Linearity improved, and high-end output greatly improved.

Rf-output coupling for the generator is made with a small loop in the oscillator section. Two methods can be used for a connection. If no further shielding of the unit is used, a BNC connector is mounted on the rear wall of the oscillator cavity as shown in Photo A. Carefully drill a hole in the back plate to accommodate the threaded ferrule of the connector, as shown. A pick-up loop about 1/8 inch by 5/8 inches is positioned parallel to the tuning capacitor and soldered into the BNC connector. This works well. However, for low-level higher frequency work, adequate shielding is really required.

The rf field from the oscillator is strong, and some of the tuning openings cut in the tuner act as slot antennas at harmonic frequencies, making low-level work impossible. Consequently, a different coaxial method is used to pass through the printed-circuit-box shield.

This rf coupling consists of a ferrule made from brass tubing with an inner diameter equal to the outer diameter of the coaxial cable insulator, as shown in Photo B. An 8-inch length of RG-58/U is trimmed as shown, and the end of the tubing is filed with a notch for easy soldering. The ferrule and coax are mounted as the back shield is assembled.

The shield is made from printed-circuit material which, in the photographs, is 1/32-inch double-sided stock. However, a single-sided material can be used.

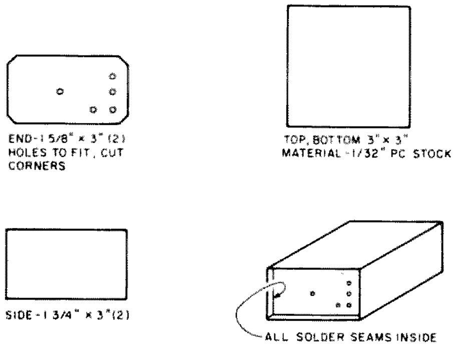

Fig. 3. Shield box dimensions. Actual sizes are determined by the tuner used.

UHF TV Channel	Sound Carrier Frequency
14	475.75 MHz
18	499.75
27	553.75
35	601.75
43	649.75
52	703.75
60	751.75
68	799.75
77	853.75
(83)	(889.75)

Table 1. UHF TV channels and the frequencies of the sound carriers associated with them.

The parts are cut approximately as shown in Fig. 3, with the detail dimensions to fit the tuner. The front end is drilled for the tuning shaft and mounting screws, and the rear drilled for the coax ferrule and coaxial bypass capacitors.

Locate the rear-end piece so that the coaxial ferrule is aligned through both the shield and cavity. The ferrule is first soldered into the tuner. Then the rear shield is positioned as shown in Photo A and soldered. The coaxial cable is inserted so that the end of the insulation is just flush with the end of the ferrule. The loop is formed and soldered about 1/8 inch by 5/8 inches as shown. The fanned-out braid is soldered to the outside of the ferrule. This keeps the 50-Ohm impedance and eliminates rf leakage. Replace the tuner covers before shielding.

In order to avoid any unsoldered slots leaking rf, the sides of the shield are soldered on the inside corners (copper facing inward), and the end pieces are located inside the side pieces (copper facing outward) for soldering on the interior surfaces, as shown in Fig. 3. Each of the two side pieces is clamped in a right-angle holder for soldering. An iron with a long tip is invaluable. The larger the box, the easier the soldering will be. The 1/32-inch PC material can be cut with

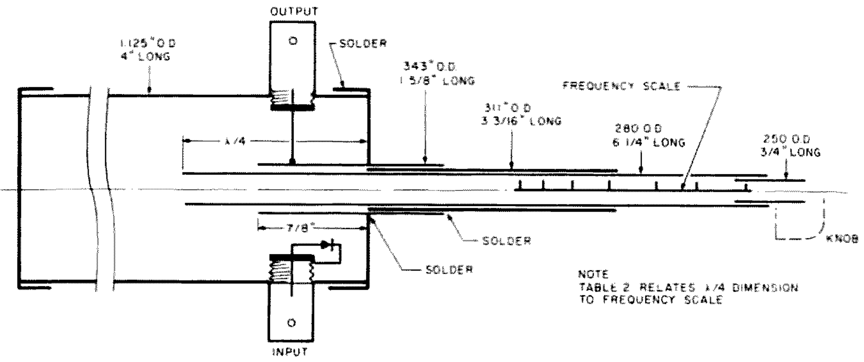

Fig. 4. Cross section of the cavity resonator used for the harmonic generator.

heavy scissors, which makes it easy to fabricate. The usual one-ounce copper PC material is OK because rf cannot penetrate it at these frequencies. When completed, the only hole in the shield should be the shaft opening, with the solder seams continuous.

The oscillator voltage should be limited to 12 volts and should be regulated with a good quality IC-type regulator for stability and low noise, although the current is only about 10 milliamperes. "Mostly AM" modulation is accomplished by capacitively coupling low-level audio or video, limited to about 0.1 to 0.3 volts, into the base of the transistor (Fig. 1). FM modulation is capacitively coupled to the varactor diode, as are the afc or fine-tuning voltages, if desired.

Dial and Calibration

A dial blank cut from clear plastic made a disc 4 inches in diameter. Two circles were scribed on the disk with radii of 1-1/2 inches and 1-3/4 inches to facilitate marking. A clearance hole was made through the disc, and then it was cemented to the hub of a cut-down tuning knob which fits the coarse-tuning shaft. See Photo C. The gearing ratio spreads the tuning over about 340 degrees, which gives a readable dial for the frequency range.

A TV set with detent channel tuning was used for calibration. This will give reasonable accuracy if the input is kept low enough so that the TV set afc doesn't pull the frequency very much to track the oscillator. Remove the TV antenna to keep the input low. A very low-level af signal at 500 to 1000 Hertz is used to FM-modulate the generator (Fig. 1). The TV set is tuned to a local UHF station and the audio tuned in with the fine tuning at the lowest possible signal strength. The TV set fine tuning is not changed during the calibration procedure. As seen from Table 1, there are TV sound channels on or near each 50 MHz within about 1%, except for channel 83 at the end of the dial.

Frequency	Quarter wavelength
1000 MHz	7.5 cm
1500	5.0
2000	3.75
2500	3.0
3000	2.5
3500	2.14
4000	1.875
4500	1.67

Table 2. Quarter-wavelength distances for coaxial cavity center conductor calibration. Refer to Fig. 4.

Mount the dial and cursor temporarily as shown in Photo C. The plastic dial is marked on the reverse side with a non-washable marking pen for neatness. For each 50-MHz dial calibration point, set the TV to the appropriate channel and then tune the oscillator down from the high side for a weak interference pattern (bars) on the screen. Then further carefully adjust the generator tuning until the sound is tuned in. The picture pattern should still be seen, so you will know that you are not tuned to the image frequency—which is 90 MHz lower. Repeat the procedure to check the calibration. The calibration marks should come out in a regularly-spaced pattern. Rub-on numbers can be used for the frequency settings on the dial.

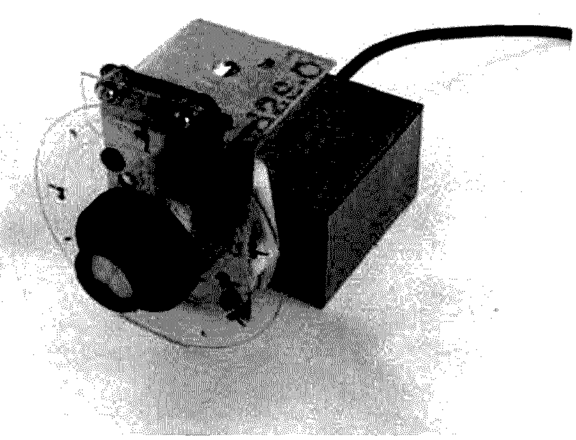

Photo C. Dial assembly with cursor temporarily mounted for calibration.

Harmonic Generator

A diode frequency multiplier is used in the harmonic generator to excite a wide tuning-range coaxial reentrant cavity resonator for the frequencies above 900 MHz. For easy fabrication, the center coaxial assembly is made of thin-wall brass tubing, available in hobby stores. It comes in successive concentric sliding-fit diameters from 1/16" to 5/8", with a wall thickness of about 0.015".

The outer tubing of the cavity is a brass toilet-overflow tube, 1-1/8" o.d., available in most hardware stores. The ends of the cavity are 1" copper-tubing caps which have an i.d. of 1-1/8". The caps are cut about 3/8" long with a hacksaw. A hole is drilled in the center of one piece for the center conductor of the resonator, as seen in Photo D. The dimensions of the cavity parts are shown in Fig. 4.

As a design aid for maximum efficiency in this type of construction, the following design rules were used.

1) For maximum Q, the ratio of the inner conductor o.d. to the outer conductor i.d. should be about 3.6, representing an impedance of about 77 Ohms.

2) Sliding electrical contacts are hard to make and harder to keep efficient. Therefore, use quarter-wave chokes at joints wherever possible. In chokes, minimize the spacing between the conductors (i.e., for low impendance).

3) The bearing sleeve for

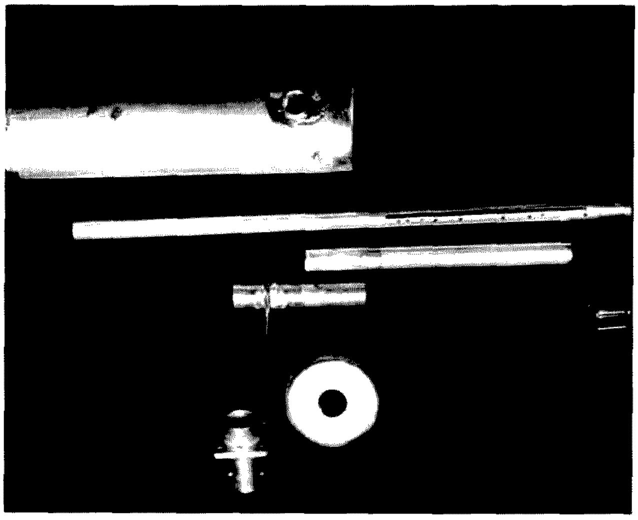

Photo D. Component parts of the harmonic generator prior to assembly. Only one BNC connector and one end cap are shown. The center conductor has been scribed for calibration.

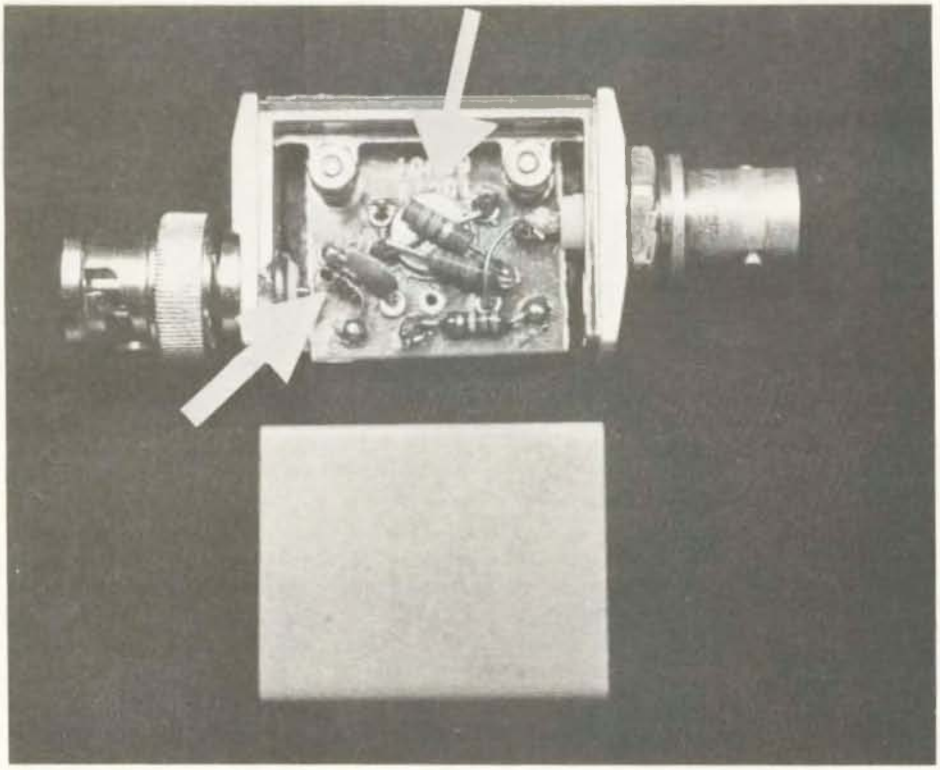

Photo E. Detector assembly. Arrows point to hot carrier diode and to the battery.

the adjustable center coax member is at least one-quarter-wavelength long at the lowest frequency used.

4) Allow about two diameters of the center-coax-member clearance to the end cap at the extended (low-frequency) position of the inner conductor. This reduces end effects which would affect the linearity of the tuning scale.

5) The rf feed-coupling loop is close to the short-circuited end of the cavity, and the ground end is returned to the BNC connector to reduce losses. The loop is actually the harmonic-generating diode. The loop size should be small compared to the wavelength to minimize frequency pulling.

6) If possible, have the interior of the completed coaxial assembly silver plated. A thickness of 0.0001" is adequate[1] and will not affect the sliding fit.

7) The output is tapped to the center conductor rather than loop coupled. This gives greater output (Photo D).

8) The copper and brass parts should fit well before soldering, and good low-loss soldering helps.

9) Several diode types were tried to get the best harmonic output without idling circuits. The best output came from selecting diodes of the 1N914 type. Idling circuits were not used, to simplify tracking when changing frequency.

The parts of the cavity were cut to size and assembled loosely to position, and file notches were made to locate the assembly positions while soldering. Pre-tin the mating surfaces to help the solder flow. The threaded cable bushings for the BNC connector are first inserted from the inside of the cavity wall, as seen in Photo D. The output connection wire is insulated with a piece of coax center insulator cut to length and inserted before final assembly.

The brass tubing is not hard enough to make contact fingers, but a contact improvement can be made to more sharply define the tuning. In order to do this, slightly compress each end of the coax support bushing by rotating against a flat or in the jaws of long-nose pliers. This cold-working tends to make a tight fit on the sliding center coax conductor. Wear life is limited, but it gives some improvement in output.

Detector

Several types of diodes were compared for best sensitivity, including 1N914, microwave 1N21, and TV-mixer diodes. The

Photo F. Harmonic generator assembled.

Photo G. Attenuator assembled.

best sensitivity was obtained from hot carrier diodes with a small amount of forward dc bias. These diodes developed as much as ten times the rectified af signal of the other types. Both Motorola HEP R0700 and Hewlett Packard 5082-2835 types worked equally well. Since then, Radio Shack has the 5082-2835 type as their part number 276-1124. A forward bias of about 0.25 volts works best, and the maximum forward voltage is 0.340 volts. The output without bias is very poor. Note also that these diodes are very sensitive to damage by electrostatic discharge.

The circuit is shown in Fig. 5. A small mercury watch battery is used in a voltage divider to develop the bias. The current drain is low, and the battery is not switched. The diode must have a dc return connection through the input circuit.

The detector assembly was built into a small mount with BNC connectors salvaged from a scope probe—see Photo E. The battery was mounted within a clearance hole drilled in the PC board, and bridging wires were soldered on either side of the PC board about 90° apart to make contact and to retain the battery. This can be seen in the photo.

The output level of the detector depends on the modulation used. With amplitude modulation on the generator, the rectified signal can be seen on an oscilloscope or detected with an audio amplifier and speaker. The scope response needs only to be sensitive to the audio frequency used, but it should be high impedance. In this way, 5 to 10 millivolts of modulated signal is easily read at the 4th or 5th harmonic, whereas it is extremely difficult to detect an unmodulated signal above the second harmonic.

In use, the harmonic generator is adjusted for the output frequency desired with AM, and then the desired modulation is used.

Attenuator

The attenuator is a waveguide-beyond-cutoff type.[2] A coupling loop lying on a diameter of a circular waveguide propagates a wave which the guide cannot support and, therefore, it is attenuated. A similar coupling loop at some distance down the waveguide picks up the energy. If the waveguide diameter is small compared to the wavelength, the relative attenuation is proportional to the separation of the loops. It is relative because of the difficulty in setting a "zero" in the vicinity of the loops. The loops must lie in the same plane and, to avoid reflections, must be terminated in the line-characteristic impedance.

For a circular waveguide, the cutoff wavelength of the lowest mode propagated is 1.71 times the diameter. For 4.2 GHz, this would be a diameter of 12.2 cm (4.8"). Therefore, an attenuator with a diameter of about one centimeter satisfies this condition. The attenuation is 31.9 dB per diameter[2] under this condition, provided the coupling loops stay in the same plane and no harmonics are transmitted. The closed harmonic for this size pipe is about 17 GHz.

Because of the end effects, the closest coupling should be about one diameter, which sets the 0-dB point at about 30 dB below the input.

The ratio of tubing diameters should be 2.31 times for 50-Ohm impedance and 3.49 times for 75 Ohms. Using tubing with an i.d. of 0.466", the 50-Ohm center conductor should be 0.188", and, for 75 Ohms, 0.124".

The tubing parts are cut to the dimensions shown in Fig. 6. Cutting is easy if a ring is filed around the tubing and the section snapped off. Small model maker's files are excellent for this. The metal film load resistors have one lead cut off, and the end is scraped so that it can be tinned and then soldered to the center conductor. The larger tubing is then soldered to the BNC fitting flange, and the ground end of the resistor soldered.

The "hot" end of the sliding tubing is expanded slightly to provide some friction-fit to the inner diameter of the barrel, as was done with the coaxial cavity parts. Small brass hinges are used to make a large hinge, preventing relative rotation of the two ends of the attenuator, as shown in Fig. 6. A relative attenuation scale is marked on the inner barrel, with the zero at about one diameter. The major marks for 30-dB intervals are separated by 0.438" (1.11 cm), and the 10-dB marks by 3.7 mm. The scale was scribed on the brass and the marks inked in.

The hinges can be omitted if the attenuator ends can be kept flat.

Conclusion

An inexpensive low-power generator has been described for the UHF and low microwaves. This generator has capability for beginning the TV and FM signal requirement at these frequencies. The component parts are modular, easy to operate, and may be used in other applications or with other pieces of equipment. The harmonic generator can operate as a wavemeter, and the attenuator will work at lower frequencies. The shielding is effective in limiting stray signal radiation. Some design parameters have been given, which may be applied to other similar equipment for these frequencies. ■

References

1. *Reference Data For Radio Engineers*, 4th edition, ITT Corp., New York, 1956.

2. *Microwave Mixers*, MIT Radiation Laboratory Series, Vol. 16., McGraw-Hill, 1948.

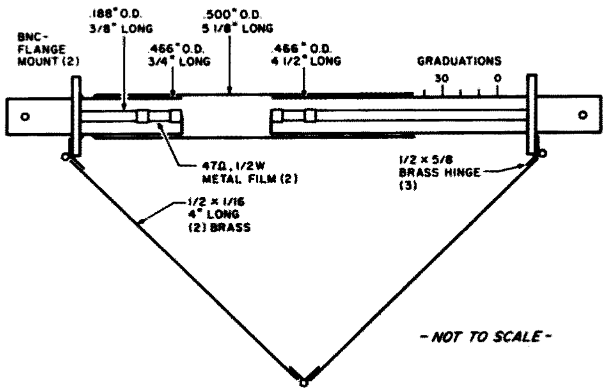

Fig. 6. Attenuator assembly shown in cross section.

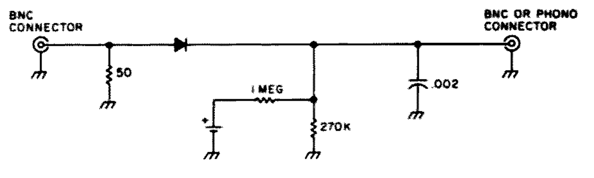

Fig. 5. The detector circuit used to set the frequency of the harmonic generator.

Satellite Television Glossary
—part II

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Margin. A 3-dB increase over the FM threshold, in a TVRO system, of the C/N which will provide an output signal completely free of impulse noise (sparklies). The FCC set this figure when CATV Earth stations were more strictly regulated.

MATV (Master Antenna Television). High-quality UHF and VHF antennas centrally located can provide TV programs for an entire apartment complex, condominium, or townhouse development. These signal distribution systems differ from CATV installations chiefly in size and degree of profit.

MDS (Multipoint Distribution System). This works like a cable system without the cable; a central microwave transmitter at 2 GHz is used to distribute one or two channels of pay TV to subscribers who have roof-mounted dishes and downconverters. The power of the transmitter is so great that the entire receiver is much less expensive than a TVRO. The MDS systems are regional, mostly in the southwest USA.

MHz (Megahertz). The standard abbreviation for millions of cycles per second. Henri Hertz was a famous scientist who pioneered wireless communications.

Microprocessor. A stored-program computer on a chip which can replace ordinary circuit parts and add functions to some manufacturers' receivers.

Microstrip. An improvement of an earlier microwave assembly technique called stripline. Double-sided microwave PC boards have etched upon them transmission lines and inductors. Capacitors and active devices may be soldered on as well.

Mixer. That part of a downconverter which joins together an input signal with that of an LO (local oscillator) to create an output signal which has a frequency that is the numerical difference between the two input frequencies. The program material in the FM carrier is not affected by the mixing process to a lower frequency.

MPAA (Motion Picture Association of America). A Hollywood trade organization which represents the film industry, assigning movie ratings and controlling movie distribution to some extent.

MTBF (Mean Time Between Failures). This is the average elapsed time before samples of a manufacturer's product fail. It is a measure of the reliability of the part.

MTTR (Mean Time To Repair). This is the average down time for a broken part. It measures the ease of repair and is used when considering the possible consequences of the part failing.

Multistage LNA. Three or more transistor amplifier stages are placed end to end (cascaded) so that the gain contribution of each one will add up to approximately 50 dB. In most LNAs the first stage, closest to the antenna feed probe, has the best noise characteristics to minimize the noise propagated along through the remaining stages.

N Connectors. Coaxial cable fittings which interface cables between the LNA and satellite TV receiver. They carry 4-GHz signals at 50 Ohms impedance with low loss.

NAB (National Association of Broadcasters). A trade organization of network affiliate VHF/UHF broadcasters.

NF (Noise Factor). This measures the thermal noise contribution of LNAs and receiver front ends. LNAs typically measure 1.5 dB (120° K) and receivers average 11-15 dB.

NTSC (National Television System Committee). The method of forming a color TV signal that is used in the western hemisphere with few exceptions. NTSC is also the Japanese standard. It has 525 lines per frame and 60 fields per second.

Octave. A measure of frequencies which differ by a factor of two in wavelength.

Orthomode Coupler. A section of waveguide such that two LNAs can be attached at right angles and simultaneously receive both horizontal linear and vertical linear polarized satellite TV programs.

Orthogonal Mode Coupler (or Transducer). See *Orthomode Coupler, above.*

P-P. Peak-to-Peak measurement of a waveform's amplitude as opposed to rms (root mean square), which is otherwise implied.

Packaging. This is the boxing of various circuit parts in a module. Typical ICs are packaged in DIPs (Dual Inline Package) with two rows of pins to fit sockets on the PC board.

PAL (Phase Alternation System). A European color TV system featuring 625 lines per frame and 50 fields per second. Generally this method gives higher resolution TV pictures than the American NTSC (525-line) color system. No PAL is broadcast from American or Canadian satellites but it may be found on INTELSATs.

Parabolic Dish. This antenna shape is commonly used to focus all the microwave energy collected on the dish surface into a single point in front of the dish called the focal point. It can be built from metal sheets, fiberglass, mesh, or wood covered with a metal reflecting surface which is accurate, with respect to a perfect parabola, to within 0.1 inch.

Passive Elements. Electrical components which do not include transistors and cannot amplify the signal. Examples are capacitors, resistors, diodes, inductors, most mixers, and transmission lines.

Path Loss. The loss incurred in a satellite TV signal from the transmitter to the receiver, while in space. Path loss can be measured on either the uplink or downlink path.

Parametric Amplifier. A complex form of LNA which depends upon a high-frequency source (Gunn-effect pump) rather than a dc source to amplify the weak input signal. It works like a MASER. The input signal modulates an electron beam and the pump amplifies it while it travels to the output coupler. These can be cryo-cooled to yield ultra low noise temperatures down to 20° K. Parametric LNAs are much more expensive than GaAsFET LNAs.

PC (Printed Circuit). An easily-made dielectric board on which nearly all the conductors and interconnections are laid out on the surface in thin copper strips and the assembly of the finished products is reduced to soldering on the parts. The wiring step is greatly reduced.

Phase. A relative position of an oscillating signal in full circle coordinates. 0 degrees is just starting, 90 degrees is one-quarter of the way through, 360 degrees is back to the starting point. Two signals are in phase if the phase difference is zero and the peaks and valleys match.

Phased Array. A technique of improving the gain of an antenna system by combining the outputs of several similar VHF/UHF/FM antennas in an array taking care that the output signals from each one are exactly in phase with one another.

PLL (Phase-Locked Loop). One form of FM demodulator which employs a feedback loop to lock a local oscillator to the same frequency and phase as the input signal. The error corrections applied back to the LO are equal to the original program signal that modulated the carrier and are passed through the circuit as the output.

Polar Mount. An antenna mounting and aiming system in which one pivot is positioned one time only and the other pivot (hour axis) is positioned to sweep the satellite arc. Some fine adjustments may be required on the first pivot (declination axis) but this mount is much easier to aim than the azimuth-elevation mount.

Polarization. In order to increase the capacity of TV satellites, transponder frequencies overlap but alternate between vertical linear and horizontal linear polarization. The dish feed and satellite feed polarizations must match or the signal will be lost. Feeds on dishes rotate 90 degrees in many designs or an orthomode coupler allows two LNAs to get both polarizations simultaneously. INTELSAT uses right-hand circular or left-hand circular polarization. Use a hybrid mode feed to receive them.

Port. A physical signal interface. This can be a waveguide flange or connector.

Potted. A form of electronics packaging in which the part is immobilized in plastic.

Power Amplifier. An active device which features a high-level signal output as opposed to an ultra low noise figure. *For comparison see Preamplifier below.*

Power Divider. A passive device similar to a signal distribution splitter but used at 4 GHz to split an LNA's signal for up to 12 separate channels (either all vertical or horizontal). A full-channel CATV or MATV system would require two LNAs and two power dividers to drive 24 separate receivers.

Preamplifier. A class of active devices in which LNAs are included and that feature low noise performance as opposed to high-level signal output. They amplify (strengthen) the signal before it reaches the relatively noisy receiver front end.

Pre-emphasis. A selective amplification of the high frequency end of a satellite TV channel prior to uplink transmission to overcome potential noise problems. Each satellite TV receiver reverses the transformation in its de-emphasis circuits.

Prime Focus Antenna. A parabolic dish antenna in which the LNA is located out in front of the dish at its focal point. This type of feed design is generally the least expensive.

Private Terminal. A TVRO which is not associated with CATV but is for the benefit of a private individual viewer.

Probe. The driven element in a microwave dish antenna system. It is located in the feed and converts rf energy in the waveguide to a signal on a transmission line to the LNA.

Program Control Tones. Telephone-style audio tones preceding and following many satellite TV programs which control automatic program selection equipment used by CATV.

PWM (Pulse Width Modulation). A method used in

USSR TV satellites to encode the audio signal between the video lines of the composite TV picture.

Quieting Curve. A graph of the signal-to-noise ratio (S/N) versus the carrier-to-noise ratio (C/N) for a particular satellite TV receiver. Generally for C/N above 8 dB, S/N = C/N + 38. The point on the curve below 8 dB C/N where S/N rapidly falls off is the FM threshold.

Registered TVRO. The FCC accepts registered Earth stations so that it can be protected from possible terrestrial interference. Frequency coordination must be performed as part of the registration procedure.

Regulated Power Supply. A dc power supply which is designed to prevent minor fluctuations in line voltage from propagating into the dc output.

Resolution. A measure of detail reproduction in a TV picture which improves with increasing S/N. It is also a function of the number of scanning lines in a frame. The European color system (PAL, SECAM) has 625 lines and better resolution than the American (NTSC) 525-line system.

RFI (Radio Frequency Interference). Any electrical spurious signals in the i-f range causing static and noise in a receiver. RFI can also be caused by improperly shielded components within a receiver.

RMS (Root Mean Square). A method of measuring the average power or voltage in a sine-wave signal. *See P-P for comparison.*

Rotor Systems. A method of rotating an LNA feed 90 degrees to switch between vertical and horizontal polarizations. Many times an antenna rotor can be used with remote control from indoors.

S/N (Signal-to-Noise Ratio). A TVRO measure of picture quality expressed in dB. Broadcast studios try to put out signals above 50 dB S/N, CATV supplies 45-50 dB S/N, and typical VTRs have an S/N of 45 dB. Watchable pictures go down as far as 40 dB S/N. One or two dB above the C/N FM threshold of a satellite TV receiver will put a TVRO into the 45-dB S/N range for fine pictures.

SATCOM F1. American TV satellite operated by RCA to supply most of cable TV programming on 24 transponders (12 are vertical and the other 12 are horizontally polarized). Also referred to as just F1, it is located at 135 degrees west longitude.

SATCOM F2. American TV satellite operated by RCA to supply assorted video and data programming to Alaska and other points in the USA. Like its sister, F1, it has 24 transponders. It is located at 119 degrees west longitude and can be also referred to as just F2.

Saturated Transponder. A satellite TV transponder which is operating at full power. They do not have agc circuits, so the output transponder power is proportional to the received signal from the Earth. Sometimes the uplink signal is backed off so that the transponder will have a longer useful life. In that case, EIRP levels on the Earth will also be proportionally lower.

Schottky Diodes. High-frequency solid-state rectifiers used to build microwave mixers.

SCPC (Single Channel Per Carrier). One stream of data or programming on a satellite communications carrier as opposed to multiplexing many voice or data subchannels within a given carrier frequency. Mostly used for voice (telephone), many separate carriers having different frequencies can fit into a 36-MHz-wide satellite transponder.

Scrambling. Techniques to encipher a TV signal to prevent unauthorized reception without a descrambler device. Typically this is done by coding the sync information of the video signal. None of satellite TV for CATV use is scrambled.

SECAM (Sequential With Memory). A French color TV system with 625 lines per frame and 50 fields per second. It is also used in the USSR.

Sensitivity. This performance parameter measures the input signal required to produce an adequate picture from a satellite TV receiver.

Shielding. The design process in which electronic components are protected by sheet metal or other conductors from spurious signals. Coaxial cables are shielded by the outer conductor, which is grounded.

Shrouding. Protective walls or screens around a dish antenna which stops side interference. It is not needed at most Earth-station sites.

Sidelobes. Areas from which noise can leak into a dish antenna from the side. Sidelobe performance is the ability of a given dish to reject these in favor of the satellite signal.

Signal Combiner. This is the reverse of a signal splitter. It allows several TV signals on different channels to be merged onto a single broadband transmission line. Many times this device can be substituted for by a signal splitter connected in the reverse direction.

Signal Distribution System. A network of signal amplifiers, splitters, and cables bringing satellite and off-the-air TV to a number of separate TV sets. Usually all the parts are 75-Ohm devices with baluns to convert to a TV set's 300-Ohm antenna terminals.

Signal Splitter. This is a passive device which enables two or more TV sets to divide a TV signal between them with proper balancing and isolation. It can be supplied in either 75- or 300-Ohm impedances.

Signal Trap. A passive device which filters out a selected channel. This can be used to control the distribution of a premium (pay-TV) channel or to remove a source of interference.

Single Conversion. This technique uses just a single local oscillator and mixer to convert a satellite TV signal from 3.7-4.2 GHz down to the final i-f (usually 70 Hz). Lower parts count and ease of assembly are important advantages over double conversion but care must be taken to prevent noise on the image frequency from leaking into the output.

Sky Noise. Background microwave radiation coming from deep space which can be a noise source for dish antennas. Sky noise provides a lower boundary for the possible noise temperature of any dish antenna and is approximately 16-20° K.

SMA Connectors. Miniature fittings to conduct signals between parts of a downconverter using small circular waveguide.

Snow. Dot-type TV interference associated with weak signals in UHF/VHF TV pictures. *See also Sparklies.*

SNR. See *S/N.*

Solar Interference (Outage). Twice each year, the sun's path will position it behind the TV satellites in a direct line of sight with TVROs. Care must be taken to prevent concentrated heat from cooking the delicate LNA at this time if a prime focus antenna is used in a TVRO.

Space Attenuation. The loss in a TV satellite signal due to the fact that the beam spreads out after leaving the antenna. This is a major factor in path loss.

Sparklies. Weak signal noise which appears as a dot or streak interference in a satellite TV picture. Loss of lock in an FM video demodulator causes this, and in extreme cases tearing or loss of the picture will result.

Spherical Antenna. This is an alternate form of dish antenna, easy for the layman to construct and having a circular cross-section instead of a parabolic one. Another feature is the ability to employ multiple feedhorns in front of the dish to receive signals from up to 10 TV satellites at once within a 40 degree orbital arc. Its design was invented by Oliver Swan.

Spot Beam. An antenna downlink pattern which provides a continent-sized footprint for an INTELSAT satellite. Generally the term describes any narrow satellite beam confined to a specific relatively small area.

SPTS (Satellite Private Terminal Seminar). An industry educational and trade show conducted three times a year in various locations by Robert "Coop" Cooper.

Stability. The ability of a tuning circuit to avoid drift that most often is caused by ambient (surrounding) temperature changes. Lack of stability is the main reason that afc circuits are used in satellite TV receivers. Crystal control provides the best stability. The term is also used to describe the ability of an amplifier to resist feedback of the output signal around to the input side. Home-built LNAs may become unstable and begin oscillating if leakage is not prevented.

Sweep Generator. A test-equipment device which creates a signal evenly over a range of frequencies. They are used to align frequency-sensitive components such as filters.

Sync Pulse. Sync is an abbreviation for synchronization. Horizontal and vertical oscillators lock on these spikes in a TV set. It is part of the video picture information in the composite TV signal.

Tearing. A form of weak signal interference which causes ragged streaks on the TV picture in vertical lines joining light to dark transitions. If this occurs in a satellite TV picture it is a good indication that the receiver is operating well below FM threshold.

Termination. A connector or passive device at the end of a signal transmission line. This is like an end cap to maintain the impedance of the line.

Terrestrial Microwave. Communications links on the ground using microwaves. One of the allowed ground frequencies is the same as the band allocated to TV satellites, and frequency coordination is needed by commercial TVROs to resolve conflicts.

Test Equipment. Auxiliary electronic signal generating and measuring devices used to tune and troubleshoot electronics equipment, including LNAs and satellite TV receivers. Some of these are: sweep generators, signal generators and markers, frequency counters, volt-ohmmeters, and oscilloscopes.

Test Pattern. This color bar pattern helps satellite TV technicians properly maintain uplink and downlink equipment. It seldom appears on VHF/UHF TV, but on TV satellites it occurs when a transponder is unused.

Threshold Extension. A circuit technique, sometimes located in the loop filter of a phase-locked loop demodulator, which improves the low signal performance of a receiver by lowering the FM threshold by 3 dB C/N.

Tilt Attenuator. A form of signal attentuator which compensates for the fact that high frequency signals lose more strength than low frequencies over a given run of transmission line. One of these is inserted into a signal distribution system just before a trunk-line amplifier.

Translator. A TV repeater which operates on UHF channels 70 to 83 (806-890 MHz). It retransmits ordinary broadcast TV to areas which cannot get direct reception.

Transients. Fluctuations in power supply voltages which can cause noise in a receiver and sometimes, if powerful enough, can damage delicate transistors in the LNA or receiver.

Transponder. Satellite hardware which implements a channel. It consists of a receiver 36 MHz wide in the 6-GHz uplink band and a broadcast transmitter 36 MHz wide on the 5-GHz downlink band. TV satellites have 12 or 24 transponders.

Turnkey. An equipment supplier who installs everything for the end user who only has to "open it with his key." This is the most expensive but most professional installation method.

TVRO (Television Receive-Only). Acronym for a satellite TV receiver (Earth station) consisting of dish antenna, LNA, and one or more receivers.

Tweaking. Tuning by hand to optimize performance of a circuit after assembly. Also called alignment.

Twinlead. A 300-Ohm transmission line to carry TV signals to the set. It is made in the shape of a flat ribbon, having lower losses than coaxial cable (coax) but being less resistant to rf interference.

TWT (Traveling Wave Tube). A high-power microwave amplifier on board TV satellites. Each transponder has one.

UHF (Ultra High Frequency). TV channels 14 through 83 (470-890 MHz), which are 6 MHz wide.

Ultra Low Noise LNA. See *Parametric Amplifiers.*

Uplink. The Earth station which transmits TV programs to the satellite for relay back to the ground. It is also the name for the communications path from the Earth to the satellite.

Vco (Voltage-Controlled Oscillator). A signal-generating component which provides an input to the downconverter and demodulator portions of a

satellite TV receiver. The oscillator's frequency is determined by an applied voltage.

VCR (Video Cassette Recorder). *See VTR.*

VHF (Very High Frequency). TV channels 2 through 13 in the following bands: channels 2-4 occupy 54 through 72 MHz, channels 5-6 occupy 76 through 88 MHz, and channels 7-13 occupy 174 through 216 MHz.

Video Monitor. A high-quality television screen lacking a tuning circuit which accepts video baseband inputs directly from a TV camera, VTR, or satellite TV receiver with no modulator required. They are not mass-produced and are ironically more expensive than TV sets of the same size.

Vswr (Voltage Standing Wave Ratio). A measure of the efficiency of a signal interface, especially the impedance match of the antenna to the LNA.

VTO (Voltage-Tuned Oscillator). *Also called a Vco (see above).*

VTR (Video Tape Recorder). A useful adjunct to a satellite TV system.

ITU (International Telecommunications Union). Deals with timely issues such as frequency band allocations worldwide.

Waveguide. A microwave conductor shaped in the form of a rectangular tube to prevent signal loss. Size WR229 is used for 3.7-4.2-GHz satellite TV signals. It can be pressurized to remove ambient moisture and further increase its performance.

West Coast Feed. Satellite TV programming time shifted and broadcast primarily for the benefit of west coast viewers. If one misses a favorite movie on the east coast feed, he can watch it four hours later on the west coast transponder.

WESTAR I. American TV satellite operated by Western Union. It has only 12 transponders and is located at 99 degrees west longitude.

WESTAR II. American TV satellite in the WESTAR series located at 123.5 degrees west longitude. It also has just 12 transponders.

WESTAR III. American 12-transponder TV satellite in the WESTAR series which is located at 91 degrees west longitude.

Wind Loading. The force upon a satellite TV dish and supports caused by air pressure. Generally, a dish should be able to withstand 120 mph (193km/h) and be able to sustain a 40-mph wind without damaging the picture.■

HAM HELP

I need instruction manuals and schematics for a Singer/Gertsch frequency meter (model FM-6) and a Hickok model 670 oscilloscope. I will promptly reimburse with thanks for loan to copy or copying costs.

Leslie W. Bruce W0OX
335 S. 40th Street
Boulder CO 80303

I am in need of a schematic for a Sideband Engineers model SB-450 transceiver. I will be glad to pay duplicating and mailing costs, or I will duplicate on receipt and send back by mail.

Alex Haynes
2703 Hambleton Rd.
Annapolis MD 21140
(301)-956-2302

I would like to obtain information from other radio amateurs on two-meter repeater locations in New England. I am in the process of compiling a listing of two-meter repeaters in New England showing exact locations (mountaintops, buildings, etc.). Other information such as autopatch capabilities (access codes not necessary), RACES affiliation also are wanted. Glad to share information with anyone interested.

Ed Soomre N1BFF
1 Alcott Drive
Northboro MA 01532

I need a copy of the scanner circuit that was popular for the HW-202 in 1975. Mine has stopped working.

Gordon Lauder W9PVD
Rt. 2
Webster WI 54893

I am collecting club bulletins from all over the world. Who will send me a copy of his club bulletin? I'll send ours plus postage costs.

Marc Demoor ON1GR
Vredestraat 13
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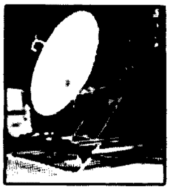
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Going Bird Hunting?

—Satellite Central, part III

Stephen Gibson
PO Box 38386
Hollywood CA 90038

Aside from making your equipment work, finding the satellite may be your biggest problem. Typical dish-antenna beamwidths run less than 2 degrees, so you may end up scanning the skies for hours. You can cut the job down to only a few minutes, however, if you know the location of the satellite relative to your particular location. Here's how to do it.

By now you know that most of the interesting TV satellites are located in geosynchronous orbit above the Earth's equator. The idea of equatorial satellites is not new. In fact, this ideal coverage spot was suggested nearly 37 years ago by famed science-fiction writer, Arthur C. Clarke, who published an article in *Wireless World* called "Extra-Terrestrial Relays." Fancy that! It's taken some time for the idea to catch on. Bob Cooper W5KHT suggested that we name the belt after Clarke. Good idea.

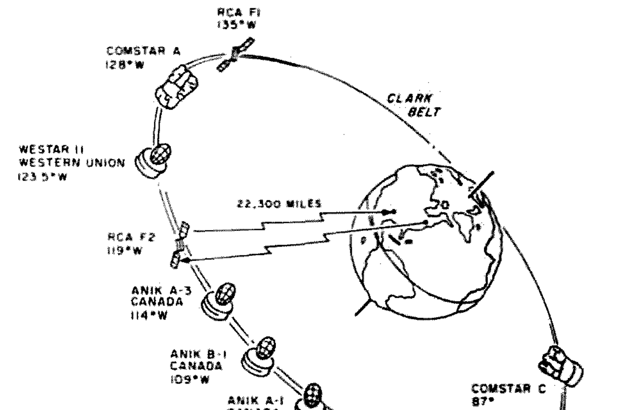

Fig. 1. Geostationary satellites. Clarke-belt satellites circle the globe above the equator at the same rotational speed as the Earth. They appear to us as fixed points in the sky, which simplifies antenna pointing.

Can we see Clarke-belt satellites as we did Sputnik? You'd have to really squint because they orbit the Earth nearly 22,300 miles out! To an observer here on Earth, the satellites in Fig. 1 appear to be standing still because they circle the Earth every 24 hours . . . and in the same direction. This makes tracking a piece of cake. Just point the dish and walk away, hoping a whiff of wind doesn't blow you off boresight!

Getting Our Bearings

To locate a satellite, we must use some frame of reference or coordinate system. While astronomers use the galactic, ecliptic, and equatorial systems, we can take the easy way and use the horizon-coordinate system because the satellites appear to us as static points in the sky. Horizon coordinates are simply azimuth and elevation. Think of elevation as being so many vertical degrees up from your horizon and think of azimuth as a horizontal twist around to the satellite from a point looking at true north. The vertical tilt and the horizontal twist are seen in Fig. 2. That's all there is to it.

Let's get some idea of what the belt looks like from your location. We also can find a good spot for the dish at the same time. Go outside and look at the southern sky (readers below the equator look north). If you are at a medium latitude, say 30 to 40 degrees north, imagine a giant rainbow arch sweeping across the southern sky from east to west with its highest point about 45 degrees off the horizon (see Fig. 3). Perhaps your imaginary rainbow passes through a tree or rooftop. If so, you'd better find another spot for your dish.

At this point it's a good idea to do some research, and either calculate, compute, or buy a computer printout of satellite coordinates for your specific location. Then go outside again and pinpoint the direction of each satellite you may want to receive before

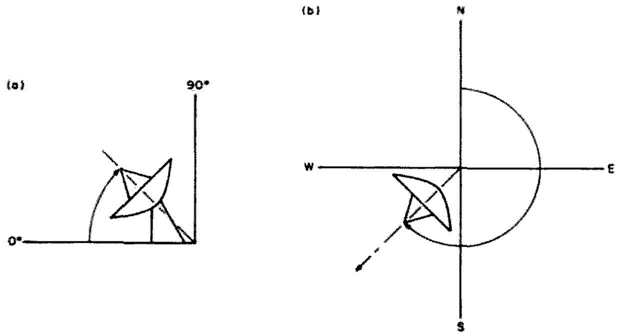

Fig. 2. Az/el coordinates are simple to understand. Elevation is a vertical tilt. Azimuth is a horizontal twist from true north (not magnetic north). (a) Elevation angle is measured from your horizon. (b) Azimuth angle is measured from true north turning clockwise.

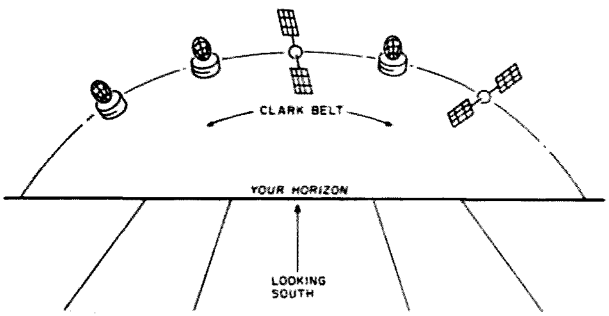

Fig. 3. To an observer at 30 to 40 degrees latitude, the Clarke belt appears as a giant rainbow. At the equator, the Clarke belt appears directly overhead stretching east and west.

Go Crazy Doing It Yourself

The following cookbook procedure is a summary of several articles on the subject which I've reduced down to three formulas. Even at that, you may find the process burdensome without a full-function programmable calculator. In the unlikely event that you are reduced to the bare essentials of just a cheapy pocket job or, God forbid, a book of trig tables, here are the exact steps to take:

1) Find out if the satellite is visible from your location and skip this step if you're pretty sure the bird can be seen. Otherwise, calculate the following (watching the signs!):

LD = Satellite Longitude − Your Longitude

Stop here if LD is greater than 81.3 degrees: You can't see it because it's below your horizon.

Then, where LAT = your latitude (use a negative latitude if you are below the equator) and AD = the number of angular degrees you are from the satellite subpoint, do:

$AD = \cos^{-1}(\cos LD \cos LAT)$

AD must be *less* than 81.3 degrees or you should forget it.

2a) Calculate azimuth if you are in the *northern* hemisphere, where LAT = your latitude:

$AZ = 180 + \tan^{-1}(\tan LD/\sin LAT)$

2b) Calculate azimuth if you are in the *southern* hemisphere by using a negative sign in front of latitude, where LAT = −(your latitude):

$AZ = \tan^{-1}(\tan LD/\sin LAT)$

3) Calculate elevation angle:

$EL = \tan^{-1}(\cos LD \cos LAT - .151/\sqrt{1-(\cos LD \cos LAT)^2}$

You can read more about bird hunting and even dig into the math in the following references:

"Microcomputers and the Satellite Station," Taggart, *73*, February, 1980.

"Locating Geosynchronous Satellites," Johnston, *QST*, March, 1978.

"Calculating Antenna Bearings," Shuch, *Ham Radio*, May, 1978.

Satellite Navigator Manual, Gibson, published by STTI.

you start pouring a concrete antenna base. A friend of mine skipped this step and accidentally erected his dish so that the best TV satellite worth viewing was directly behind a tree!

Even a clear shot doesn't mean you won't have problems, however. I recently moved to a mountaintop where nothing would block my view. Nothing, that is, except heavy interference from Ma Bell who just happens to share this same frequency band (3.7-4.2 GHz)! Ma Bell is a different kind of blockage. I'll cover the illness and the cure for interference in a future "Satellite Central."

Finding All the Info

Scores of articles (and even books) have been published on how to calculate satellite bearings. I've assembled a bibliography of a select few in the box on this page so that you can go hunting for back issues. Or you can scan the pages of *73* for someone who'll generate a bearing chart for you by computer. If you own a computer or know somebody who'll lend you one, you can use the program listing given here. It's nothing fancy, but it will give you answers with even greater accuracy than you need to point your dish.

It doesn't matter if you opt for graphs or calculators or even a computer to do the work. You still need three pieces of information before you begin: (1) The longitude of the desired satellite, (2) your longitude, and (3) your latitude.

Perhaps you're wondering why we need only the longitude of the satellite? Another look at Fig. 1 will show you that despite their distance, the latitude of the birds is really zero because they orbit directly above the equator. That's zero degrees latitude. So all we need is longitude. This is measured in degrees running east or west from Greenwich, England. If you look at the program listing, you'll see the west longitude of nearly all Clarke-belt satellites down in the data statements.

Next, you'll need your site coordinates. Like the satellites, your location is measured from the same references, Greenwich, England, and the equator. A good place to look for your coordinates is on a topographical map. You can buy one for your area from a map store or direct from the Department of the Interior. Aeronautical maps are another good source. Even an atlas will do.

If you can't find a map, call a local radio or TV station and use their coordinates. Perhaps the coordinates of the club repeater will do if it's not too far away. Your local airport tower may be able to give you their coordinates. As a last resort, look in books dealing with astrology! You may find coordinates for your city or one nearby because astrologers also need coordinates to construct their charts.

Hair-Splitting Accuracy

Despite what the purists may say, practical experience has proven that you can be 15 or 30 miles off in coordinates and still find the bird! It's really all a matter of accuracy in

Program listing.

```
10 CLEAR : RESTORE : CLS
20 PRINT"CLARK BELT SATELLITE PROGRAM"
30 PRINT:'(C) 1981 STEPHEN GIBSON
40 '
50 PRINT"EARTH STATION COORDINATES:":PRINT
60 PRINT"LONGITUDE - INPUT DECREES,MINUTES,SECONDS"
70 INPUT VD,VM,VS
80 INPUT"IS THAT EAST OR WEST LONGITUDE (E/W) ";V$
90 PRINT:PRINT"LATITUDE - INPUT DEGREES,MINUTES,SECONDS"
100 INPUT HD,HM,HS
110 IMPDT"IS THAT NORTH OR SOUTH LATITUDE (N/S) ";N$
120 '
130 CLS
140 PRINT " CLARK BELT SATELLITE ANTENNA BEARINGS"
150 PRINT " "
160 PRINT"SATELLITE","LONGITUDE"," AZIMUTH"," ELEVATION"
170 PRINT " "
180 '
190  S$="W":' WEST LONG FOR ALL SATELLITES!!
200 G = VD+(VM+VS/60)/60 : A = HD+(HM+HS/60)/60
210 IF A=0 THEN A=.001
220 IF V$="W"THEN G=-G
230 IF N$="S"THEN A=-A
240 '
250 'CALCULATIONS
260 FOR J=1TO54 : READ SA$ , F :F = -F
270 B = G - (F)
280 IF B>180 THEN B = B-360
290 IFB<-180THEMB=B+360
300 IFB=>81.3THEN D=B-81.3: GOTO 520 :' ERROR!!
310 Q=(COS(B*.0174533))*(COS(A*.0174533))
320 C=(-ATN(Q/SQR(-Q*Q+1))+1.5708)*57.29578
330 IFC=>81.3THEND=C-81.3: GOTO 520 :' ERROR!!
340 '
350 ' DO PRINT-OUT
360 C1=C*69.057:'MILES TOO SUBPOINT (NOT USED)
370 AA=180+(ATN(TAN(B*.0174533)/SIN(A*.0174533)))*57.29578
380 IFA<=0THENAA=AA-180
390 R=3957:H=22245
400 S=SQR((R↑2)+((R+H)↑2)-2*R*(R+H)*COS(C*.0174533))
410 EE=(((S↑2)+(R↑2)-((R+H)↑2)))/(2*R*S)
420 E=(-ATN(EE/SQR(-EE*EE+1))+1.5708)*57.29578-90
430 '
440 PRINT SA$ , ABS(F) , AA , E
450 '
460 NEXT
470 '
480 INPUT"WANT ANOTHER Y/N ";A$: IF A$="Y" THEN 10
490 '
500 END
510 '
520 ' ERROR FLAG
530 PRINT SA$," BELOW HORIZON BY ";D;" DEGREES":GOTO 460
540 '
550 DATA "ATS-3",69,"GOES-1",75
560 DATA "COMSTAR 3",87,"WESTAR 3",91,"COMSTAR 2",95,"WESTAR 1",99
570 DATA "ANIK A1",104,"SMS-1",105,"ANIK A2",106.5,"ANIK B",109,"ANIK A3",114
580 DATA "-CTS-",116,"SATCOM 2",119,"WESTAR 2",123.5,"COMSTAR 1",128
590 DATA "SATCOM 3R",132,"SATCOM 1",135,"SMS-2",135
600 DATA "ATS-6",140,"ATS-1",149,"STATSIONAR 10",170
610 DATA "INTELSAT IV F4",181,"MARISAT 2",183,"INTELSAT IV F8",186
620 DATA "STATSIONAR 7",220,"-CS-",225,"-ETS-",230,"-BSE-",250
630 DATA "STATSIONAR T",261,"EKRAN 2",261,"EKRAN 1",261,"STATSIONAR 6",275
640 DATA "PALAPA 1",277,"STATSIONAR 1",280,"PALAPA 2",283,"MARISAT 3",287
650 DATA "INTELSAT IVA F3",297,"INTELSAT IV F1",298.6,"INTELSAT IV F6",300
660 DATA "INTELSAT IV F5",300,"STATSIONAR 5",302,"SYMPHONIE 1",311
670 DATA "STATSIONAR 9",315
680 DATA "INTELSAT IV F7",1,"INTELSAT IV F2",4,"SYMPHONIE 2",11.5
690 DATA "STATSIONAR 4",14,"SIRIO",15,"MARISAT 1",15,"INTELSAT IVA F4",19.5
700 DATA "INTELSAT IVA F1",24.5,"STATSIONAR 8",25,"INTELSAT IVA F2",29.5
710 DATA "INTELSAT IV F3",34.5
720 END
```

pointing your dish. The typical readouts you might use, such as a carpenter's inclinometer or a compass, may get you within a couple of degrees, anyway. It's like trying to read fractions of mph on your auto speedometer! That's why accuracy in calculations to several places is unnecessary. We'll attempt to solve this problem later on with a digital or analog readout.

There is a limit to the number of satellites that you can see from your location. The curvature of the Earth blocks your view. The limit of your visibility is about 81 angular degrees in any direction. And, because the satellites are located above the equator, you will see fewer birds as you move north or south. If your antenna were located on the equator, you could look ± 81 degrees along the Clarke belt and see a maximum number of birds. It's a great location except that very few birds lay footprints on the equator. See "Satellite Central, part I" (*73* for November) about footprints. So, you've got to move towards the footprints to receive pictures.

As you move farther away from the equator, the birds on the ends of the belt begin to drop below your horizon. At a point roughly 81 degrees north (or south), all the satellites drop from your view. What? No satellite TV at the north pole? At Thule, Greenland, for example, SATCOM II is just about 1 degree off the horizon. The Armed Forces Network uses a massive dish pointed at the horizon to receive transponder 9.

Signal level is not their only problem. At nearly zero degrees elevation, the dish intercepts terrestrial noise from the Earth which greatly increases their noise floor.

Save Time With a Computer

Perhaps the best way to get satellite bearings is with a computer. It's fast, accurate, and eliminates any drudgery other than merely typing the program into the machine. The listing given with this article is short and devoid of any fancy formatting because I have no idea which machine you'll be using. It's in Microsoft BASIC. Take it from there.

In a nutshell, the program asks for your coordinates and then calculates azimuth and elevation for each satellite in its 54-satellite data base. You can add new birds to the data statements as they are put into orbit. Just be sure to adjust the size of the FOR/NEXT loop on line 260 to accommodate them.

Buried in the code, down in line 400, is the calculation for what is known as slant-range. It is the distance to the satellite from your location and not much use to you unless you want to calculate signal level and happen to have an intensity-matrix overlay somewhere else. You still may want to include it in the printout. Just print the variable S in line 440. Then add ,"DISTANCE" onto the end of line 160 so you will have a title for the distance column (don't forget the comma). You also will find that C1 in line 360 is the distance to the satellite subpoint, a spot on the globe directly below the bird. You may want to print it, too.

The formulas don't work for the special case of an Earth station exactly on the equator. Everything works fine if you move the dish a short distance north or south. I've inserted a minor fudge factor of a few seconds of latitude in line 210 just in case you want to test your suspicions and see that a dish at that spot would indeed have an azimuth bearing of 90 degrees or 270 degrees. While fudge factors are not a very good idea, especially in a computer program, it sure beats getting a "division by zero" error message. Besides, the output still will be accurate to within 7.2 seconds of arc! It's hardly worth mentioning when you consider the *real* effort will be erecting that 10-to-20-meter dish on the equator to receive what few signals are actually available!

Other mods worth considering are an error trap so that only visible satellites are printed. You may also want a software counter so that the ouput doesn't scroll off the screen until the program receives a keyboard command. If you

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have a printer, it's a simple matter to change all the PRINT statements to LPRINT. Or you could store the answers in another array, then branch to a printer subroutine. TRS-80 Model I users need only POKE the printer device control block with the CRT vectors and LPRINT thereby, having their cake and eating it with optional branches.

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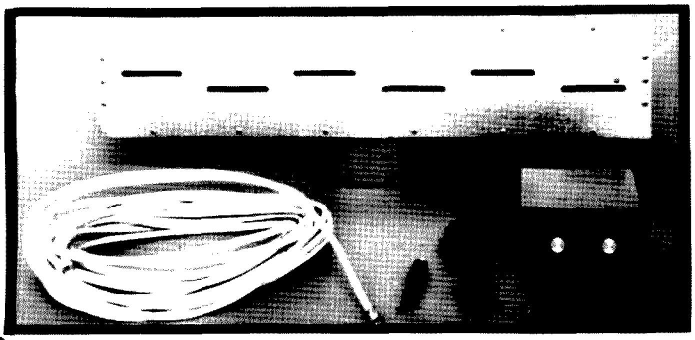

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Micro-Programmed Controllers

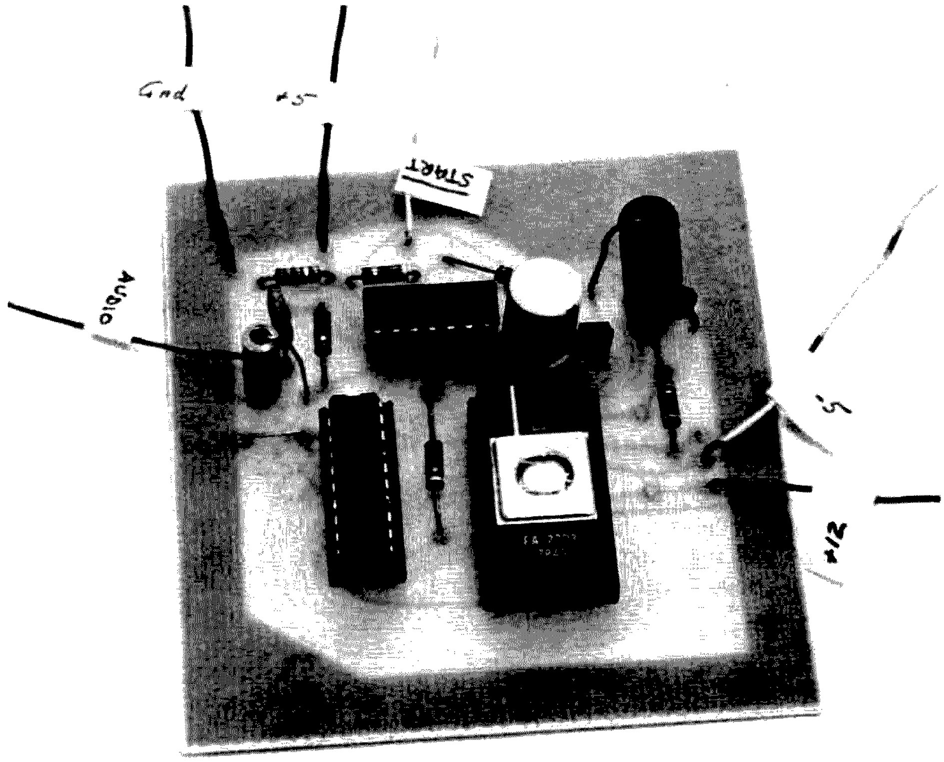
—bridging the gap between TTL and microprocessors

There are many times when you need some sort of digital circuit which gets its inputs from somewhere else, makes some simple decisions based on those inputs, and then feeds its outputs to still elsewhere.

A good example is a repeater control circuit. This device gets some inputs—usually digital signals which signal some on/off condition with either 0 volts or +5 volts—from other parts of the repeater such as a timer, input carrier detector, or touchtone™ decoder. The control circuitry monitors these inputs, and when certain conditions are satisfied, it sends out control signals to other parts of the repeater such as the transmitter keying relay or an autopatch.

Obviously, such a device is called a controller because it controls things. Although I'm using a repeater control circuit as an example, in reality controllers are much more useful. A controller can be used to control a complex RTTY station, a home heating system, or a burglar alarm.

Controllers used by hams typically take one of three forms. In the simplest cases, a controller may be built out of relays. In somewhat more complex systems, a controller might be built out of digital logic devices such as the 7400-series TTL integrated circuits which are used in most ham repeaters. And a few repeaters have controllers that use a microcomputer. Obviously, the more complex a controller, the more sophisticated control it can provide. And the computerized repeater systems have some really impressive features.



Relay controllers and controllers built out of just digital logic often are called hard-wired controllers. Their functions are wired into the system. Changing the way the controller works or fixing a bug requires that the wiring be changed.

Computerized controllers, on the other hand, are programmed controllers. Their functions are coded into a computer program which controls the computer. To change what the controller does or to fix a bug, you leave the wiring alone but change the program. This makes modification of the system a snap.

For some simple applications, however, programming a digital microcomputer can be overkill. For these cases, it would be

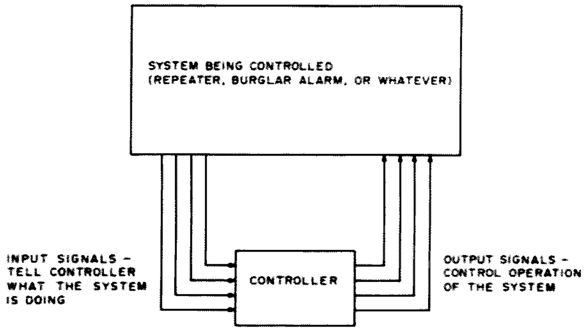


Fig. 1. How a controller fits into a system.

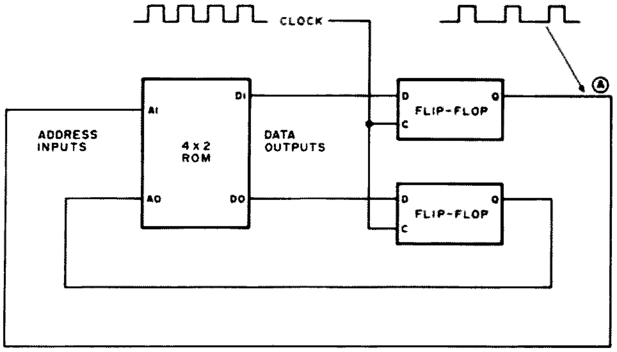


Fig. 2. A very simple micro-programmed sequential circuit.

nice to have a simpler device which uses some hard wiring but which can also be programmed to allow simple modifications or improvements as time goes on. Such a device is the micro-programmed controller.

A micro-programmed controller has a program which controls its operation but doesn't have a computer to go with it. Hence, it is much simpler to understand, build, and use. It doesn't have the full power of a computerized controller, but for most simple control jobs, it is good enough.

Micro-programmed controllers are nothing new; in fact, many computers have one inside them for control of their own internal operations. They are seldom used on their own, however, primarily because they are not well known. The purpose of this article is to introduce this very useful and powerful device to hams.

Sequential Controllers

Fig. 1 shows a simple block diagram of how a controller fits into a system. There are inputs from the system to the controller which tell the controller what is going on in the system. In a repeater, for instance, these might come from the carrier-operated relay (COR) or from tone decoders; in a burglar alarm, these might come from door and window switches.

In turn, the controller sends back some output signals which do things in the system. In a repeater, these might turn on the transmitter or autopatch; in a burglar alarm, they might ring an alarm bell.

Depending upon what the controller does, there are two types of controllers—combinatorial and sequential controllers. Both types have some inputs and provide some outputs. In a combinatorial controller, those outputs depend upon only the present inputs. In a sequential controller, the present outputs depend not just on the present inputs but also on past inputs.

Another way to look at this is as follows: For a particular combination of inputs, a combinatorial controller will always do the same thing, but a sequential controller has memory and will do different things if input signals arrive in a different order.

Consider the example of a burglar-alarm controller. In a combinatorial controller, every time the front door opens, the alarm bell rings. If there is a screen door just outside the main door, then the combinatorial controller will ring the bell when the main door opens even if the screen door is closed. But this would ring the bell when you leave the house.

On the other hand, a sequential controller could be connected to both doors. It could be set up so that if the screen door opens first and then the main door opens, the bell rings. But if the main door opens before the screen door, then the alarm does not sound. This controller would allow someone to go out but not in. In other words, the sequence of inputs is important.

A sequential controller also can provide a sequence of outputs. It could pulse the alarm bell on and off, or turn it off after ten minutes, or it could alternately pulse a bell and a siren, or toot a song on several horns of different pitch. A combinatorial controller can't do that.

Obviously, a sequential controller is more useful and interesting. It's also more difficult to build. A combinatorial controller can be just a series of relay contacts or simple digital logic which provides an output when some particular combination of inputs is present. A sequential controller, on the other hand, has to have some built-in memory to remember what has happened in the past, and often must have some delay circuits or timers as well. This is why complex ham controllers often have complicated digital logic circuits or microcomputers.

Micro-Programmed Sequential Controllers

A lot of people think that programming a microcomputer is called micro-programming. Not so. Micro-programming means programming on a small scale. In this case, we program a simple circuit to do some very simple things.

Fig. 2 shows a very simple micro-programmed sequential circuit consisting of a read-only memory (ROM), two type-D flip-flops, and some sort of clock to generate pulses which go to the flip-flops. (This circuit is so simple that it doesn't have any inputs or outputs to the outside world. Hence, this sequential controller can't do anything useful—yet.)

The ROM is a digital memory. It is divided into a number of locations, each of which stores a binary number. In Fig. 2, this is a 4 × 2 ROM, meaning that it has four separate memory locations and each stores two binary digits.

(In case you are not familiar with digital logic, the binary digits (bits) are either 0 or 1. In most common digital circuitry, a 0 is carried along a wire as a voltage of 0 volts, or very close to it, while a 1 is represented by a voltage above 2 volts. Although we tend to think of 0 and 1 as being 0 volts and +5 volts, since these are the supply voltages used in TTL integrated circuits, the most common voltage for a 0 is about 0.2 volts, and the most common voltage for a 1 is between 3 and 4 volts.)

Each of the four locations has an address; this address also is a binary number. In this case, we need two bits to specify an address. The four different addresses are 00, 01, 10, and

11. (Only the digits 0 and 1 are allowed in binary numbers, and these are all the possible combinations that you can make out of a pair of bits.)

The ROM memory has a set of address inputs and a set of data outputs. When you feed in an address on the inputs, the ROM "looks up" the contents of the location you've addressed and feeds the contents of that location out over the data outputs. The 4×2 ROM shown in Fig. 2 has two address input lines (since it needs two bits to specify one of its four addresses) and also happens to have two data output lines, since each location only holds two bits. As such, this is a tiny ROM—so small that nobody makes it. A typical manufactured ROM might have 1024 memory locations with 8 bits in each location.

The ROM gets its data by being programmed. Some ROMs are programmed in the factory when manufactured; other ROMs can be programmed in the field. The particular ROMs hams use most often can not only be programmed in the field, but can also be erased; they are called EPROMs, for Erasable Programmable ROM.

Suppose we programmed the 4×2 ROM as follows:

Location (Address)	Contents (Data)
00	01
01	10
10	00
11	11

This shows exactly what is in it. Each of the four locations has a two-bit number. Let's remember this pattern as we go on.

In Fig. 2 is a pair of type-D flip-flops. A flip-flop is a digital logic device which has a memory. When you apply a bit to its D (data) input and put a pulse on its C (clock) pin, it will memorize that bit and keep sending it out the Q output for as long as power is applied or until the next data bit and clock pulse arrive.

In this case, the data arrives from the ROM and is supplied to two flip-flops, one for each bit. The clock signal is a series of pulses generated by some sort of oscillator which arrive at regular intervals. Every time a clock pulse arrives, the two flip-flops memorize the binary data coming out of the ROM and then feed the data back out their Q outputs. This output will then stay there until the next clock pulse arrives, at which time it may change.

Now, we notice that these Q outputs go right back to the address inputs of the ROM—so this is some sort of feedback circuit. If you are at all familiar with feedback, you will remember that feedback does strange things . . . like make amplifiers oscillate. That's exactly what can happen in this case; it can make the ROM oscillate. But the flip-flops can be thought of as a delay. When an output comes from the ROM, it doesn't enter the flip-flops until the next clock pulse. If the clock pulses are arriving very slowly, then there may be a long delay from the time the output of the ROM comes to the time it finally reaches the address inputs. The ROM can oscillate only as fast as the clock pulses arrive.

Now let's go back to the pattern we programmed into the ROM earlier, and let's assume that we somehow start with the flip-flops putting out a digital signal of 00. This 00 is sent back to the ROM as an address. Since the ROM has been programmed with a 01 at location 00, it will feed a data output of 01 to the two flip-flops.

At some time later, a clock pulse arrives. All of a sudden, the flip-flops get triggered and memorize the 01 pattern. Now they output 01 back to the ROM's address inputs.

The ROM now gets an address of 01, and so it outputs 10 as data. This goes to the flip-flops, but again nothing happens until a clock pulse arrives. When it does, suddenly the 01 on the flip-flop outputs changes to 10. This goes back to the ROM's address inputs so that the ROM now outputs 00, the number we programmed into location 10. But again, nothing happens until the clock pulse comes. When it finally arrives, the 00 will appear on the flip-flop outputs, and we're right back where we started.

If you leave the circuit sitting there for a long time, it will simply keep cycling back and forth: 00, 01, 10, 00, 01, 10, 00 . . . and so on. It goes through a sequence of addresses. If we call each different address a state, we see that the number going into the ROM is the "present state" while the number coming out will be the "next state." We could rewrite the ROM memory table like this:

Present State	Next State
00	01
01	10
10	00
11	11

Once we're in present state 00 (in the left column), we will go to state 01 (right column) when the clock comes. When we're in state 01 (left column), the next state after a clock comes will be 10 (right column). Finally, from a present state of 10 we'll go right back to 00.

While the circuit is going back and forth like this, we could connect an oscilloscope to point A (see Fig. 2) and would see the waveform shown, since this line is a 0 for two clock pulses and a 1 for one clock pulse. This circuit could, therefore, take a symmetrical clock pulse and produce an output which is unsymmetrical. You can see that, given enough states, we could make this waveform as complex as we'd like. (Later, I'll show you how to build a CW identifier using just three integrated circuits.)

Suppose, though, that somehow we had started off with the flip-flop outputs equal to 11. This table shows us that location 11 has the data 11, so the next state also will be 11. In this case, the circuit will just lock up and stay in the 11 state forever.

So, we have here a circuit which will go through a succession of states following exactly the pattern which is programmed into the ROM. But we have to be careful not to mix up the bits being fed back or the sequence of states will not be the right one. We do this by noting which of the address inputs is the left digit and which is the right. In Fig. 2, we see that the address inputs of the ROM are labeled A1 and A0. When we write

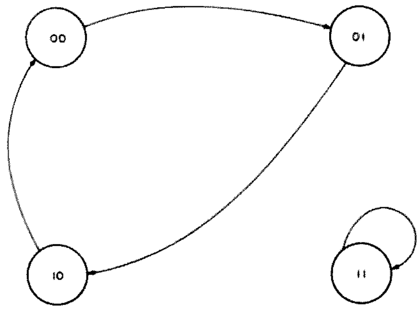


Fig. 3. State map for the circuit in Fig. 2.

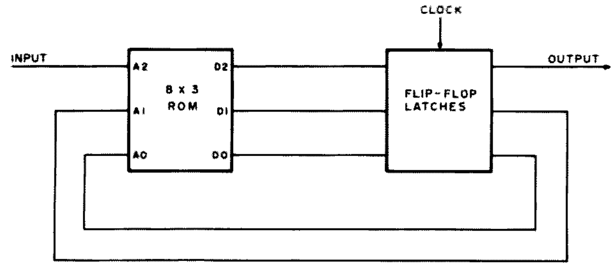
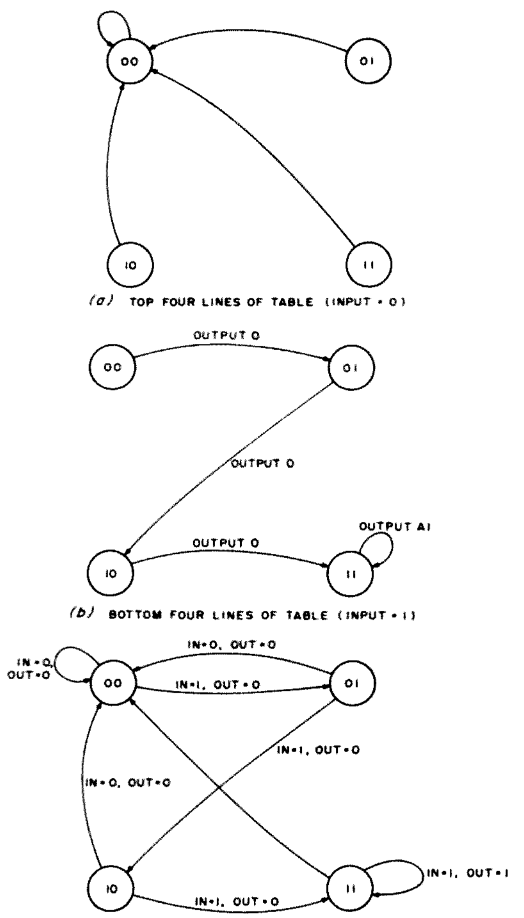


Fig. 4. A more complex controller.



(a) TOP FOUR LINES OF TABLE (INPUT = 0)

(b) BOTTOM FOUR LINES OF TABLE (INPUT = 1)

(c) COMBINATION OF (a) AND (b)

Fig. 5. State map for Fig. 4.

these two bits down on paper, A0 is at the right and the bits are numbered higher as we go left. (For instance, a ROM having ten address inputs would have them numbered from A0 on the right to A9 on the left.) In the same way, D0 is the data bit at the right, and we must make sure that D0 goes around in such a way that it comes back to A0, not to A1.

To make the operation of a circuit like this easier to understand, we use a "state map" or "state diagram," as in Fig. 3. In this map, each state is shown as a circle which is numbered with its state. Like one-way roads on a road map, arrows show how we go from state to state. From state 00 we go to 01, from 01 to 10, from 10 back to 00. But if we're in state 11, then the road leads right back to 11.

Let's look at the more complex circuit in Fig. 4. Since this ROM has three address inputs and three address outputs, it is an 8×3 ROM (there are eight possible ways we can write the three address bits and there are three bits per location). We now need three type-D flip-flops, but rather than showing them individually, we just show them as a big box. Since these flip-flops grab an input and hold it until the next clock pulse, they are usually called latches.

This time we don't feed all the outputs back to the input. We reserve one of the address lines as an input from somewhere else and use one of the latch outputs for an output to somewhere else. Only two lines are fed back. (The fact that this ROM has the same number of address inputs as data outputs is just coincidental. Most modern ROMs have more address pins than data pins. For instance, the EPROM in Fig. 9 has ten address inputs and only eight data outputs. Sometimes all the outputs go back to the inputs and other times only a few lines go back. It all depends on the application.)

Now, let's assume that this 8×3 ROM is programmed as follows:

Location (Address)	Contents (Data)
000	000
001	000
010	000
011	000
100	001
101	010
110	011
111	111

Notice in Fig. 4 that the two bits on the right of each set are being fed back through the latches; let's call these two bits "the state." The remaining address bit will be the input bit, and the remaining data bit will be the output bit. Then we can rewrite the table. The first column will look like this:

Input	Present State
0	00
0	01
0	10
0	11
1	00
1	01
1	10
1	11

and the second column will look like this:

Output	Next State
0	00
0	00
0	00
0	00
0	01
0	10
0	11
1	11

What does this table tell us? The top four lines of each say this: As long as the input is 0, regardless of what state we're in, the output will be a zero and we will go to state 00 next. This means that when the input is a 0 for a long time, the circuit simply locks up in state 00 and keeps providing a 0 output all the time. The state map for these four lines is shown in (a) in Fig. 5.

Now, suppose that we're in state 0 for a while and suddenly the input changes from 0 to a 1. All of a sudden we're on line 5 of the input table—input 1, present state 00. Then, after the next clock pulse (let's repeat that again—*after* the next clock pulse), the output will stay at 0 but we will go to state 01 (down to line 6 of the input table).

The state map for the last four lines of the input table is shown in (b) in Fig. 5 and shows how we move from state 00 to state 01 if the input is a 1.

If the input should go back to 0, we'd move back to line 1, and at the next clock pulse, we'll simply shoot back up to state 00 again. But let's assume the input stays at 1 for a while. Then, at the next clock pulse, we'll move to state 10. When we're in state 10 with the input still 1, the next clock pulse moves us to an output of 0 and state 11.

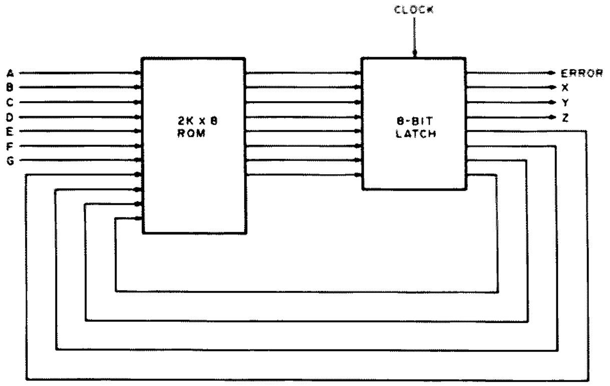


Fig. 6. Digit-sequence detector for touchtone.

At this point, we're in state 11 with an input of 1. At the next clock pulse, we stay in state 11, but the output goes to 1. If the input now stays at 1, we will stay in state 11 for a long time. We can see this clearly from the state map in (b).

But when the input finally goes back to a 0, which brings us back to the state map in (a), we will switch suddenly to line 4—input of 0 and present state 11. That means that the next clock pulse will bring us back to state 00 with an output of 0.

So, this is a delay circuit of sorts. If the input is 0 for a long time, the output stays 0. When the input goes to 1, the output stays at 0 until four clock pulses later, at which point it finally goes to 1, too. But if the input goes to 0, then the output drops back to 0 at the very next clock pulse. A circuit like this might be usable in some sort of alarm, for instance.

Although we broke up the state map into two parts, (a) for the case when the input is 0 and (b) for the case of a 1 input, we usually combine both parts, as in (c) in Fig. 5, and carefully label all combinations of input and output.

Although the function of this controller could just as well be done with a simpler circuit, the point here is that just by reprogramming the ROM we can get the same circuit to do something completely different. For instance, we could change the last two lines of the table as follows:

(Column 1)		(Column 2)	
1	10	1	11
1	11	0	10

The circuit here would oscillate between states 11 and 10 and would pulse the output on and off. This could pulse an alarm bell a certain time after a door opened for instance.

Now we see why this is called a micro-programmed sequential controller. It is programmed via very simple (micro) instructions, it operates in a certain sequence, and it can be used to control things.

This idea is a very powerful one. For instance, if we had a ROM with ten address inputs and eight data outputs, we could feed back, say, four data lines to become addresses. Using these four lines to mark our states, we get a total of sixteen states (there are 2-to-the-4th or 16 possible ways of arranging four 0s and 1s). That leaves six address lines to be used for inputs to the circuit and four data lines for output. A circuit like this could be used as a fairly neat traffic-light controller. The six inputs might go to traffic sensors and a timer, while the four outputs would control a pair of red and green lights. The circuit could then switch the lights in a prearranged sequence, depending on the external timer inputs and the presence of traffic.

Just two more concepts before we look at another practical example.

The number of memory locations depends on the number of address lines, because these determine how many different addresses we can make. With two lines, we could have only four different addresses (00, 01, 10, and 11). With three address lines, we could have eight addresses; with four lines we could have 16 addresses. The equation to use is: Number of locations $= 2^n$, where n is the number of lines. For instance, the ROM with ten address lines has 1024 memory locations, since $1024 = 2^{10}$.

In electronics, a k means 1000. In digital computer talk, K means 1024, so the above ROM would be called a 1K memory. If you examine Fig. 9 carefully, you will see that that circuit uses a 1K×8 ROM, since there are 10 address lines and 8 data lines.

The other thing to keep in mind is that binary numbers are easy to use if they are small. But talking about big binary numbers like 10011110 gets confusing. Hence, most computer people use a different number system. Either octal or hexadecimal (hex) is used, but hexadecimal is currently more popular. In hex, a binary number is divided into groups of four bits, and each group is then replaced by its corresponding hex digit. As shown in Table 1, hex uses the digits 0 through 9 and the letters A through F. Since 1001 is 9 and 1110 is E (see Table 1), the binary number 10011110 would be written as 9E in hex.

This is easy to do when the binary number has 4, 8, 12, or 16 bits. But when it has 9 or 10 bits, how do you split them into groups of four? The secret is to add zeros in front of it to stretch it out to a multiple of four bits. For instance, the binary number 110011110 would be stretched out to 000110011110, split up into 0001-1001-1110, and then written as 19E in hex.

Decimal Number	Binary Number	Hex Number
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

Table 1. Binary and hex numbers.

A Micro-Programmed Tone Decoder

Many repeater control circuits use touchtone™ signals (a dual-tone signaling system) for repeater control. The actual tones are detected by either tuned-circuit filters or 567 phase-locked loop ICs, and the detected outputs are then used to control repeater functions. Detecting the tones and providing an output for each tone is fairly simple; detecting a sequence of digits (such as dialing the number 1234) and providing an output only when these digits are dialed in the right order is a bit more tricky. A variety of circuits have been used, but a micro-programmed sequential controller can do the job just as well and with less hardware. (Just three ICs, in fact!)

Fig. 6 shows a simplified diagram of the scheme. If we use a 2K×8 ROM (which has 2048 memory locations and, therefore, 11 address-line inputs and 8 data-line outputs), we need an 8-bit latch. Feeding back four data lines from the latch leaves seven input lines and four output lines.

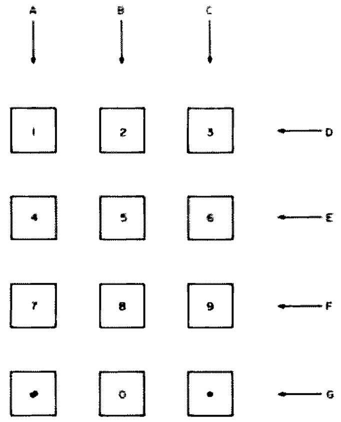


Fig. 7. A typical touchtone dial.

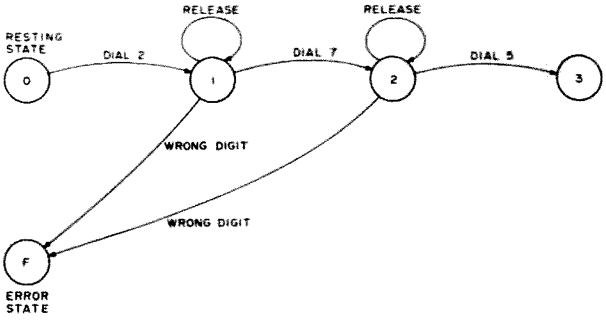


Fig. 8. Partial state map for touchtone-sequence detector.

Let's connect the seven inputs to seven outputs from the touchtone decoder. (There are seven tones used, so we would have seven tone decoders with each one providing one output to the ROM.) To keep things simple, let's call these inputs A through G.

On a touchtone dial, each digit generates a combination of two tones, depending upon the row and column position of that digit on the keyboard. All the keys in the left column of the touchtone keyboard, for example, generate two tones, one of which is 1209 Hz. Call the output of the 1209-Hz decoder A. In the same way, all the keys in the center column would generate the B signal, and so on, as shown in Fig. 7. For any particular digit, then, two input signals are generated; the digit 5, for instance, becomes the BE combination.

Of the four outputs, let's call one the ERROR output; we will set up the system so that if an error is made in dialing or if someone is playing with the system, we get a signal on this lead. The other three outputs are called X, Y, and Z and decode three separate dialed sequences of digits.

Now, let's suppose that we want output X to go on whenever the repeater user dials the sequence *275. Fig. 7 shows that the * is a CG combination, a 2 is the BD combination, the 7 is the AF combination, and the 5 is the BE combination. So, we want our sequential controller to provide an X output when the input sequence detected is as shown in Table 2.

Between digits, however, both tones will disappear (though perhaps not at the same time). Now, how do we figure out how to program the ROM?

The solution is to start with a state map. Since there are four feedback lines, we can have up to sixteen states (since 2 to the 4th power is 16). Let's number them in hexadecimal as states 0 through F (since Table 1 tells us that a hex F is the same as a decimal 15).

With sixteen states, the state map is quite complex, so let's just show five states in Fig. 8. Let's label state 0 the "resting state" and state F the ERROR state. States 1 through 3 are then used for the *275 sequence, while states 4 through E (not shown) would be available for other number sequences.

We'll set up the program so that the controller is normally in the resting state; if it's anywhere else, dialing a * will send it there (that's the purpose of starting the *275 sequence with a *). Hence, state 0 is always the starting point for any number.

Once we're in state 0, dialing a 2 takes the controller to state 1, where it stays as long as the 2 is dialed and also when the digit 2 is released. When the 7 is dialed, the controller moves to state 2 and stays there. Finally, when the 5 is dialed, it goes to state 3. If at any time the wrong digit is dialed, the system goes to state F.

Notice that there is a tremendous amount of flexibility here. Depending on exactly how we program the ROM, we can ignore wrong digits while we're in state 0 or go to the ERROR state. We can stay in state 3 after the *275 is dialed until the next * takes us back to state 0, or we can set it up so that the system returns to 0 on the very next clock pulse. Or, we can set up another dialed number sequence to return to state 0.

We can stay in the ERROR state on an error and lock up the whole system, or we can return to 0 on the very next clock pulse. Or, we can stay in state F until a special dialed sequence returns us to state 0; this would allow only control stations to reset the system. The possibilities are immense, with the only limitation being the size of the ROM. This circuit has fourteen available states (since two are used up for the resting state and the ERROR state); since each digit requires one state, we can handle up to fourteen digits (not counting the * code). We could, therefore, decode a 14-digit number, or two 7-digit numbers, or three 3-digit numbers and one 5-digit number, or any combination we please.

Now, what about the actual ROM program? This is where the job gets slightly tedious (but not at all difficult). Since a 2K × 8 ROM is used, we have to figure out exactly what to put in each and every one of those 2048 locations. We cannot leave any location empty for a very important reason—when power is first turned on, the state of the system is unpredictable. If it should go into some state for which we did not plan, the controller could lock up in that state and never come out of it. Hence, any ROM location we don't specifically need should be programmed with some "escape" data which allows the controller to return to resting state 0.

The basic idea, therefore, is to start with a notebook and set up one line in the notebook for each of the

A	B	C	D	E	F	G	
0	0	1	0	0	0	1	(C & G tones = *)
0	1	0	1	0	0	0	(B & D tones = 2)
1	0	0	0	0	1	0	(A & F tones = 7)
0	1	0	0	1	0	0	(B & E tones = 5)

Table 2.

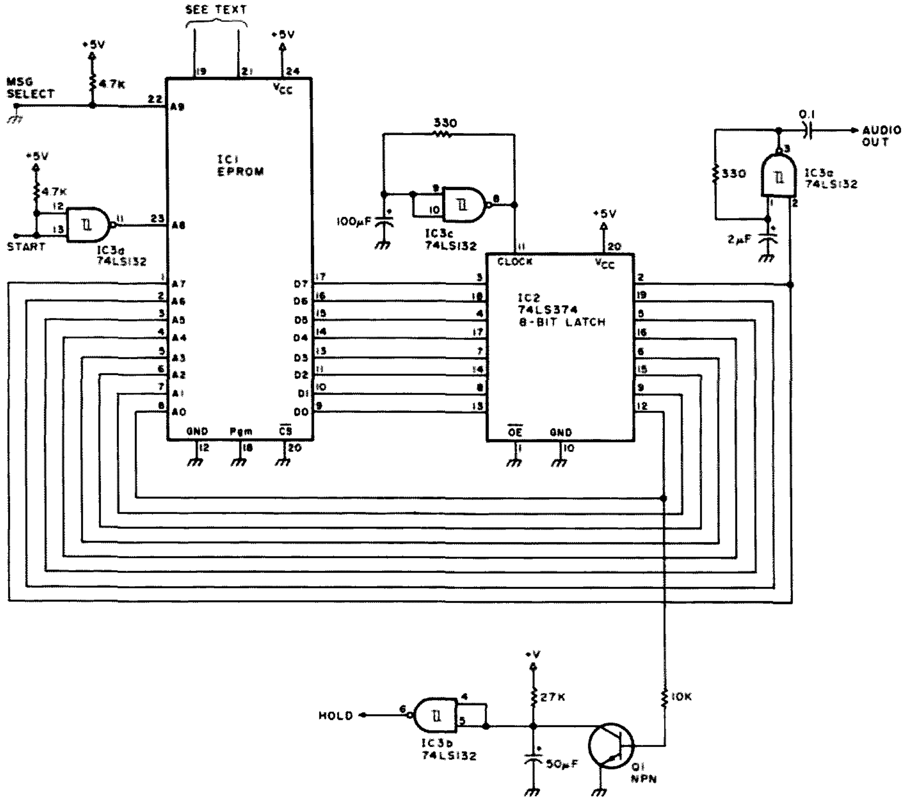


Fig. 9. CW identifier diagram. 74LS132 ground is pin 7; Vcc is pin 14.

	Inputs A B C D E F G	Present State	Outputs ERROR	X Y Z	Next State
a)	(eleven-bit address)		(eight-bit data)		
		First line:			
	0 1 0 1 0 0 0	0000 (0)	0	0 0 0	0001 (1)

	Inputs A B C D E F G	Present State	Outputs ERROR	X Y Z	Next State
	0 1 0 1 0 0 0	0001 (1)	0	0 0 0	0001 (1)
	0 0 0 0 0 0 0	0001 (1)	0	0 0 0	0001 (1)
	1 0 0 0 0 0 0	0001 (1)	0	0 0 0	0001 (1)
b)	0 1 0 0 0 0 0	0001 (1)	0	0 0 0	0001 (1)
	0 0 1 0 0 0 0	0001 (1)	0	0 0 0	0001 (1)
	0 0 0 1 0 0 0	0001 (1)	0	0 0 0	0001 (1)
	0 0 0 0 1 0 0	0001 (1)	0	0 0 0	0001 (1)
	0 0 0 0 0 1 0	0001 (1)	0	0 0 0	0001 (1)
	0 0 0 0 0 0 1	0001 (1)	0	0 0 0	0001 (1)

	Inputs A B C D E F G	Present State	Outputs ERROR	X Y Z	Next State
c)	0 0 1 0 0 0 1	0001 (1)	0	0 0 0	0000 (0)

	Inputs A B C D E F G	Present State	Outputs ERROR	X Y Z	Next State
d)	1 0 0 0 0 1 0	0001 (1)	0	0 0 0	0010 (2)

	Inputs A B C D E F G	Present State	Outputs ERROR	X Y Z	Next State
e)	1 1 0 0 0 0 0	0001 (1)	1	0 0 0	1111 (F)
	1 0 1 0 0 0 0	0001 (1)	1	0 0 0	1111 (F)
	1 0 0 1 0 0 0	0001 (1)	1	0 0 0	1111 (F)
	1 0 0 0 1 0 0	0001 (1)	1	0 0 0	1111 (F)
	etc.				

Table 4.

2048 different addresses, in order. See Table 3.

Next, remember that every unused location should get the data 00000000, which will lead to state 0 (or binary 0000) with all outputs off. This is the escape code which leads back to state 0 if the system ever gets to some unused state. No need to put all those 00000000 codes in yet, but remember them at the end.

Now make yourself a template which will indicate which bit of the address and data is what. The template should look something like the top of Table 4(a). Here we have made a start in filling in the programming table. First, we want to go from state 0 to state 1 when a 2 is dialed, but keeping all outputs off. This is just the one line of Table 4(a).

This entry says that when we are in state 0 and the BD pair of inputs comes in, we

00000000000 = hex 000
00000000001 = hex 001
00000000010 = hex 002
00000000011 = hex 003
•
•
•
11111111111 = hex 7FF

Table 3.

want to make the four outputs all 0 and also go to state 1. (The state numbers are shown in binary and the hex state number is in parentheses.)

Once we get to state 1, we want to stay in that state under three possible conditions:

1) as long as the digit 2 is still present;

2) when the digit 2 has disappeared (B and D are both gone); and

3) whenever only one tone is present. This is not shown in the state map, but is due to the fact that when one digit is dialed, the two tones it represents do not come on and off together but may follow each other with a small time delay. Furthermore, some tone decoders may output short pulses if they are triggered by noise or voice signals. Hence, we want to ignore any input which represents just one tone.

These three conditions translate into nine memory locations to be programmed as in Table 4(b).

The first line keeps us in state 1 when the BD combination (digit 2) is on; the second line keeps us in state 1 when all tones are absent; the last seven lines keep us there if just one tone is detected.

Next, we want to program in the sequence which returns to state 0 when a * is dialed. This is again just one line as in Table 4(c).

When the digit 7 is dialed, we want to go to state 2—see Table 4(d).

Finally, for every other combination of tones, we want to go to the ERROR state F—see Table 4(e).

To give the complete

micro-program for the ROM would take a few pages; besides, the exact program depends on just what options you want to include in the system. For example, the state map in Fig. 7 would ignore multiple digits (*275 would be treated the same as *2275 or *2227777775). In a repeater system where mobile flutter often breaks up one digit into two, this might be preferable, but if this were not acceptable, then breaking up each state into two states (for example, staying in state 1 as long as the 2 is still present, but going to another state as soon as it is released) would eliminate that. In any case, the program would change for every application, so there isn't much need to give one here. But you'd find that it isn't very difficult once you get started.

As to the actual circuit, something similar to Fig. 9 using a 2716 2K × 8 EPROM, a 74LS374 eight-bit latch, and a 74LS132 for buffering and clock would work out just fine. At what frequency should the clock run? The frequency should be fast enough so that a digit is not missed between two clock pulses, but slow enough so that short noise bursts which may produce tiny pulses at the outputs of the tone decoders don't confuse the system. A frequency of perhaps five pulses per second should be about right, but there is nothing critical about this value.

A Micro-Programmed CW Identifier

Here is a practical application of a micro-programmed sequential controller that a lot of hams can use—a CW identifier which has only three integrated circuits.

Fig. 9 shows the complete circuit. It consists of a 1K × 8 EPROM (in this case a 2708, but others can be used), a 74LS374 8-bit latch which contains eight type-D flip-flops, a 74LS132 quad, a 2-input Schmitt trigger, a transistor, and a handful of resistors and capacitors.

IC1 is the EPROM, hooked up to IC2 in a straightforward micro-programmed sequential controller circuit. There are eight bits brought back as feedback, which leaves two more EPROM address lines as inputs. A8 (pin 23) is buffered through IC3d and acts as the START line. The 4.7k resistor on the input normally keeps the START line at a high voltage near +5 volts, and grounding it starts the IDer.

The other input pin, A9 on pin 22, is used as a message select. In my circuit, I simply keep it grounded all the time as I don't have a second message in the ROM, but if it is allowed to go to a high voltage (with the 4.7k resistor pulling it up), this selects the other half of the ROM and allows a second call to be stored. Each call or short message requires 512 locations (½K) of storage, so the 1K EPROM has room for two messages.

Two sections of the 74LS132 act as oscillators. Up at the top, IC3c oscillates at a frequency of about 20 Hz and, therefore, clocks the latches twenty times per second. This determines the speed at which the circuit goes from one state to another and is the duration of a Morse code dot.

IC3a also oscillates, but at the much higher frequency of about 1000 Hz, and generates the CW-tone output. It is keyed on and off by latched D7 output coming from IC2, pin 2.

In many cases we need a HOLD signal which keys a transmitter whenever the IDer is active. This is done by the circuitry around IC3b. Normally, the capacitor connected to its input charges up to near +5 volts through the 27k resistor. This makes the input into IC3b high (1), so its output is a low voltage (0).

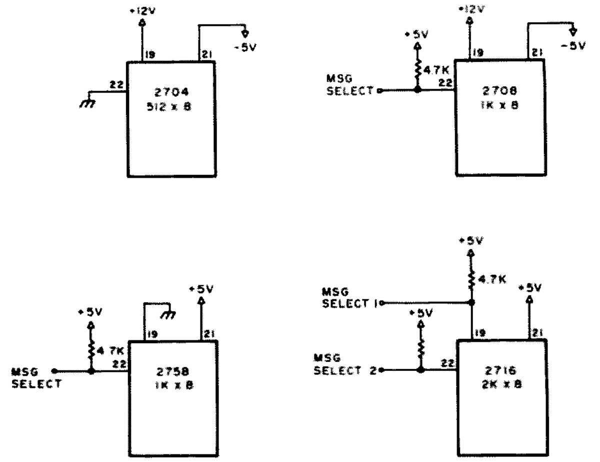


Fig. 10. Four different EPROMs can be used.

Each time the latched data bit D0 goes to a 1, however, the transistor turns on and discharges the capacitor. This makes the HOLD output go high to a 1.

When the IDer is sitting still, D0 is always a 0, and so the HOLD is always low. But as soon as it starts, D0 alternates between 0 and 1, and so the capacitor keeps being discharged all the time. Hence, HOLD goes high and stays there until a half second or so after the IDer stops.

IC1 as shown in Fig. 9 is a 2708 EPROM, available for about $6. But the 2708 has a disadvantage—it requires three power supplies of +5 volts, −5 volts, and +12 volts, respectively. This makes it hard to use. But it's possible to substitute other EPROMs. Fig. 10 shows how to change the EPROM connections for three other EPROMs; only pins 19, 21, and 22 are affected. Like the 2708, the 2704 also requires three power supplies but has only 512 locations (½K) storage. This EPROM could store only one call, and, so, pin 22 is grounded rather than being used as a message select pin. It is not easy to get since everybody has switched to the 2708 at almost the same price, but there may be some still lying around.

The 2758 and the 2716 require only a single +5-volt power supply. They are almost identical, except that the 2758 is 1K × 8, while the 2716 is 2K × 8. Quoted prices at this time are about $10 to $15 for either. The 2716 has an additional address line (pin 19) which becomes a second message select line. Since this EPROM has 2K locations, it can store four different calls or short messages. They are selected by putting various combinations of ones and zeros on the two select lines; in the rest of this article, we'll just discuss the simplest case where all message select lines are grounded.

Incidentally, when ordering a 2716, do not order the Texas Instruments TMS2716. This IC is also 2K × 8 but requires three supplies like the 2708. TI uses the number TMS2516 for the EPROM with a single supply; everyone else calls it a 2716.

Programming CW into the EPROM

Although I use a computer program to determine the bit pattern to be put into the EPROM, it's important to understand how this is done. Following RTTY terminology, a dot is called a "mark" while the space be-

MSG Select A9	Start Input A8	Present State A7-A0	Next State D7-D0
0 (Gnd)	0 (Don't)	00000000	00000000
0	1 (Start!)	00000000	00000001
(10-bit address)			(eight-bit data)

Table 5.

Location (Address) (Hex—last 2 digits are the present state)	Contents (Data) (Hex—next state)
001 and 101	02
002 and 102	03
003 and 103	04
004 and 104	05
005 and 105	06
006 and 106	80
007 and 107	83
008 and 108	84
009 and 109	0A
00A and 10A	0B
00B and 10B	0C
00C and 10C	0D
00D and 10D	00
•	•
•	•
080 and 180	81
081 and 181	82
082 and 182	07
083 and 183	08
084 and 184	85
085 and 185	86
086 and 186	09

Table 6.

01 → 02	
02 → 03	
03 → 04	
04 → 05	
05 → 06	
06 → 80	
	80 → 81
	81 → 82
	82 → 07
07 → 83	
	83 → 08
08 → 84	
	84 → 85
	85 → 86
	86 → 09
09 → 0A	
0A → 0B	
0B → 0C	
0C → 0D	
0D → 00	

Table 7.

tween two dots is called a "space." A dash then becomes three marks with no space between them, a letter space is four spaces in a row, and so on. The letter K then becomes mark mark mark space mark space mark mark mark.

A complete call requires 512 (½K) locations, numbered from 000000000 to 111111111 in binary; in hex they are numbered from 000 to 1FF.

In the EPROM, location 000 is always programmed with a 00 (so that once the sequential controller gets to state 00 it will lock up in state 00 and stay there). Location 100 is always programmed with a 01 (so that the controller will go from that state to state 1). A short table of these locations and data is shown in Table 5.

This shows that if we're in present state 00000000 (or 00 in hex) and the START input (on A8, not way back at the input to inverter IC3d) is a 0, then the next state will be 00 again. But if we're in state 00 and the START is a 1, then the next state will be 00000001 (or 01 in hex). This is how we handle the problem of getting started.

So these two locations (hex 000 and hex 100) are different in that one stores a 00 while the other stores a 01. As for all the rest of the message memory, ROM locations 101 through 1FF are an exact carbon copy of locations 001 through 0FF. In other words, once we get out of state 00 into any other state, the voltage on the START input doesn't matter any more; regardless of whether the START is still a 1 or whether it has already gone back to a 0, the sequence will be the same.

Now, what's in the rest of the ROM? Let's assume that the call consists of just the letter K (to keep it simple). The ROM contents is then as shown in Table 6. All the rest of the ROM message area is 00. What does all this mean?

First of all, notice in Fig. 9 that the latched D7 bit (which is the data bit on the left when the number is written down on paper) also happens to be the Morse code output bit which goes to the code oscillator, IC3a. When this bit is a 1, we get a tone output; when this bit is 0, we don't get any sound. When is this bit a 1? Whenever we're in any state whose state number starts with a 1; in hex, this means whenever the state number starts with an 8 or any digit greater than 8. So the IDer generates a tone (mark) in states 80, 81, and up, but not in 00, 01, or any state up to 7F.

Table 6 shows exactly which state follows which other state, but we have to pick our way through it to follow the states. It's much easier if we rearrange the lines into the same order that the circuit goes through. Let's do it as shown in Table 7, using an arrow to show how the controller follows the states. For instance, 01 → 02 means that present state 01 will be followed by next state 02.

All the states starting with 0 are at the left and represent spaces (no tone); the states starting with an 8 are at the right and represent marks (tone). Look at the marks on the right: mark mark mark (space) mark (space) mark mark mark. There's your K!

What we have, then, is six states of space (no tone), three states of mark (the dah that starts the K), one space followed by one mark (the dit), a space, and another three marks (the second dah). At the end, we have a letter space which consists of five more spaces. (The reason for the six spaces at the start is to allow the transmitter some time to come on before the letter is sent.)

In this case, we used a total of 14 space locations (states 00 through 0D) and 7 mark locations (states 80 through 86) for a start delay, one letter, and a letter space at the end. But actually we shouldn't count the six spaces at the beginning since they are a special case, so the letter K used only 8 spaces and 7 marks. With a total message space of 128 spaces (00 through 7F in hex) and 128 marks (80 through FF), this leaves us room for a message of about 15 characters. Enough to spell out something like K2OAW NEW YORK.

Programming the EPROM

Obviously, the hardest part of building this IDer is programming the EPROM; this job involves two parts—first deciding what to put in which location, and then going through the mechanics of doing the actual programming.

Deciding what to put into the EPROM can be done by sitting down with a notebook and making a table something like Table 7. Simply go through, putting down the marks and spaces which correspond to each dit and dah as well as the

spaces at the beginning, between letters, and at the end.

If a computer of some kind is available, then the program listing given here can be used. This particular program was written in SWTP BASIC for a SWTP 6800 computer, but since it's written in BASIC it should run on other small computers without much modification.

The program has an array called C which contains the dit-dah code for each letter, number, and some characters. When it runs, it asks for the message you'd like to program, converts each character in the message to the Morse code by looking it up in the table, and then figures out the EPROM pattern. It does two things with the resulting data—it POKEs it into memory and prints it out. If you have an EPROM programmer on the computer, then the data POKEd into memory could be used to program the EPROM directly; if the programmer is separate, then the printed listing would be used.

This particular version POKEs the data starting at decimal location 45056 (see line 60 of the program) which happens to be equivalent to the hex address B000 in the computer; this happened to be convenient in my system, but would probably have to be changed for other systems.

The Morse code pattern in array C is stored as two bits for each dot or dash. If the Morse code character has a dit, then the two bits are 01; a dah becomes a 11.

The letters coming from the keyboard are in a code called ASCII. For instance, the code for the letter K is hex 4B. This is equivalent to a decimal 75, so the code for K is stored in the 75th location of C, which is C(75).

Since the code for a K is dah-dit-dah, it is stored as 110111 (or 11 01 11). This binary number translates to a decimal 55, and so the Morse code for a K is defined in line 350 as C(75) = 55. Each of the other letters, numbers, and symbols is stored in exactly the same way.

Once you know exactly what data must be stored in the ROM, you must actually store it; this is called programming the ROM and requires an EPROM programmer. Such programmers come in two types—manual and programmed. In a manual programmer, each bit pattern for every location is entered by hand via switches and then a button is pushed to program that location. A programmed unit stores the entire code to be "burned" into the EPROM in its own memory first, and then programs the EPROM with that data. Most EPROMs can be programmed with a manual unit, but obviously a programmed unit is much more convenient.

If you run my program on a computer, it may be convenient to use a programmer which attaches to the same computer to transfer the bit pattern straight from the read-write memory of the computer to the EPROM. In the case of the SWTP computer, SWTP makes a 2716 programmer which also will program 2758s; a modification in a *Kilobaud Microcomputing* article (February, 1979, page 82) allows this same unit to program the 2708 or 2704; this explains my choice of EPROMs. Note, however, that there are

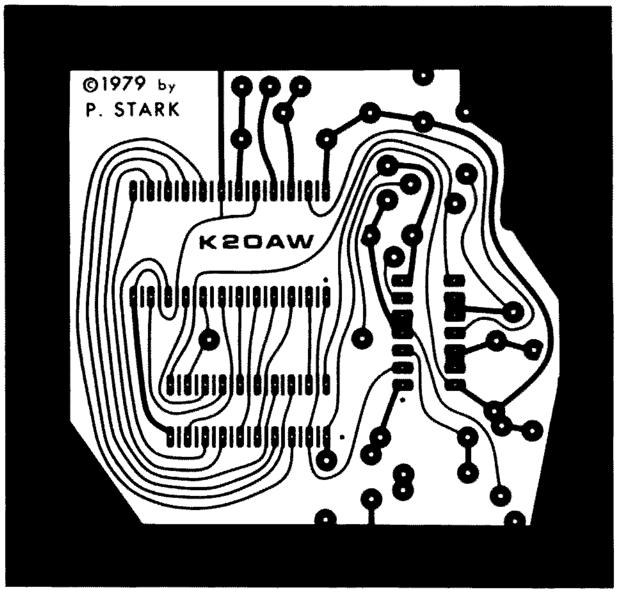


Fig. 11. PC board layout for the CW identifier (copper side of board).

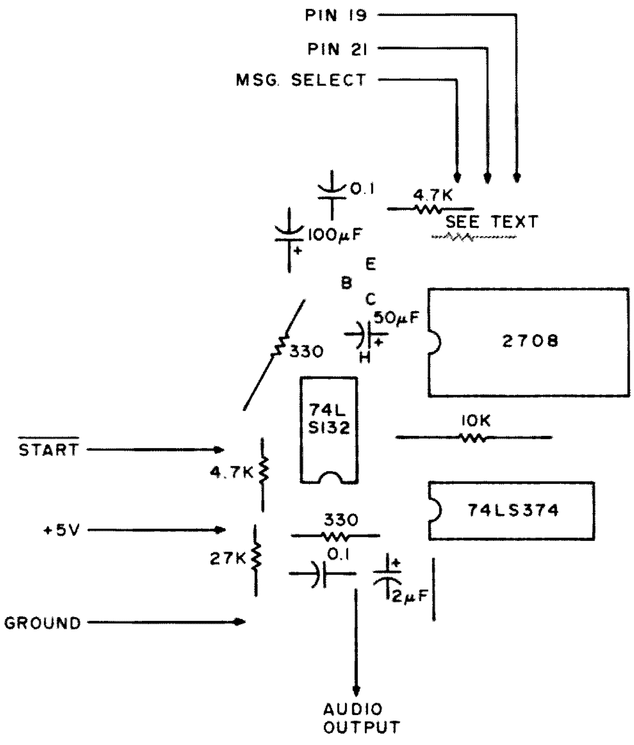


Fig. 12. CW identifier PC board parts placement (component side).

```
0010 PRINT "PROGRAM TO GET ROM PATTERN FROM GIVEN TEXT STRING"
0020 PRINT "COPYRIGHT (C) 1979 BY PETER A. STARK"
0030 PRINT "ALL RIGHTS RESERVED"
0040 PRINT : PRINT
0050 DIM C(127)                              :REM CHARACTER CODES
0060 P=45056                                 :REM ADDRESS B000 FOR BUFFER LOCATION
0070 Z=2048                                  :REM EPROM SIZE IS 2K

0080 REM FILL C() ARRAY WITH MORSE CODE

0090 C(32) = 0                               :REM SPACE
0100 C(44) = 3935                            :REM ,
0110 C(45) = 855                             :REM -
0120 C(46) = 1911                            :REM .
0130 C(47) = 861                             :REM /
0140 C(48) = 1023                            :REM 0
0150 C(49) = 511                             :REM 1
0160 C(50) = 383                             :REM 2
0170 C(51) = 351                             :REM 3
0180 C(52) = 343                             :REM 4
0190 C(53) = 341                             :REM 5
0200 C(54) = 853                             :REM 6
0210 C(55) = 981                             :REM 7
0220 C(56) = 1013                            :REM 8
0230 C(57) = 1021                            :REM 9
0240 C(63) = 1525                            :REM ?
0250 C(65) = 7                               :REM A
0260 C(66) = 213                             :REM B
0270 C(67) = 221                             :REM C
0280 C(68) = 53                              :REM D
0290 C(69) = 1                               :REM E
0300 C(70) = 93                              :REM F
0310 C(71) = 61                              :REM G
0320 C(72) = 85                              :REM H
0330 C(73) = 5                               :REM I
0340 C(74) = 127                             :REM J
0350 C(75) = 55                              :REM K
0360 C(76) = 117                             :REM L
0370 C(77) = 15                              :REM M
0380 C(78) = 13                              :REM N
0390 C(79) = 63                              :REM O
0400 C(80) = 125                             :REM P
0410 C(81) = 247                             :REM Q
0420 C(82) = 29                              :REM R
0430 C(83) = 21                              :REM S
0440 C(84) = 3                               :REM T
0450 C(85) = 23                              :REM U
0460 C(86) = 87                              :REM V
0470 C(87) = 31                              :REM W
0480 C(88) = 215                             :REM X
0490 C(89) = 223                             :REM Y
0500 C(90) = 245                             :REM Z

0510 REM ERASE THE POKE BUFFER PRIOR TO USE

0520 PRINT "ERASING BUFFER..."
0530 FOR I=0 TO Z-1
0540     POKE( P+I,0)
0550 NEXT I

0560 REM SET UP START-STOP CODES AND INITIAL DELAY

0570 PRINT "POKING DATA INTO BUFFER..."
0580 POKE( P, 0)                             :REM STOP AT LOCATION 0
0590 POKE( P+256, 1)                         :REM CONTINUE AT LOCATION 256
0600 FOR I=1 TO 5
0610     POKE( P+I, I+1)                     :REM LINK 5 MORE SPACES
0620     POKE( P+256+I, I+1)
0630     PRINT I;" = ";I+1
0640 NEXT I
0650 S=6                                     :REM NEXT SPACE BYTE
0660 M=128                                   :REM NEXT MARK BYTE
0670 INPUT "ENTER CW MESSAGE", A$
0680 L=LEN(A$)                               :REM LENGTH OF MESSAGE IN CHARACTERS
0690 FOR I=1 TO L                            :REM DO FOR EACH CHARACTER
0700     K=ASC(MID$(A$,I,1))                 :REM NEXT ASCII CODE
0710     K=C(K)                              :REM NEXT MORSE CODE
0720     IF K<>0 GO TO 830                   :REM SPACE CODE?

0730     REM SPACE CODE REQUIRES A LONG SPACE

0740     FOR J=0 TO 5
0750         POKE( P+S, S+1)                 :REM POKE 6 SPACES
0760         POKE( P+256+S, S+1)
0770         PRINT S;" = ";S+1
0780         S=S+1
0790         IF S>126 GOTO 1340              :REM ERROR
0800     NEXT J
0810     GOTO 1250  :FINISH UP WITH LETTER SPACE

0820     REM NON-SPACE CHARACTER; FIND ITS FIRST MARK

0830     IF K>=16384 GO TO 870
0840     K=K*4                               :REM ASSUME 16 BITS, SHIFT LEFT
0850     GOTO 830                            :REM TWO BITS UNTIL MARK IS FOUND

0860     REM FOUND NEXT TWO BITS - PUT IN PROPER BYTES

0870     IF K>=49152 GO TO 910               :REM DASH
0880     IF K>=16384 GO TO 1110              :REM DOT
0890     GOTO 1250                           :REM WHEN FINISHED, ADD LETTER-SPACE

0900     REM DASH

0910     IF S>125 GO TO 1340                 :REM ERROR
0920     IF M>252 GOTO 1340                  :REM ERROR
0930     K=K-49152                           :REM DELETE DASH
0940     POKE( P+S,M)                        :REM GO TO 3 MARK STATES
0950     POKE( P+256+S,M)
0960     PRINT S;" = ";M
0970     POKE( P+M,M+1)
0980     POKE( P+256+M,M+1)
0990     PRINT TAB(10);M;" = ";M+1
1000     POKE( P+M+1, M+2)
1010     POKE( P+256+M+1, M+2)
1020     PRINT TAB(10);M+1;" = ";M+2
1030     POKE( P+M+2, S+1)
1040     POKE( P+256+M+2, S+1)               :REM RETURN TO SPACE
1050     PRINT TAB(10);M+2;" = ";S+1
1060     S=S+1                               :REM UPDATE POINTERS
1070     M=M+3
1080     K=K*4                               :REM SHIFT MORSE CODE LEFT 2 BITS
1090     GOTO 870                            :REM AND REPEAT

1100     REM DOT

1110     IF S>125 GOTO 1340                  :REM ERROR
1120     IF M>254 GOTO 1340                  :REM ERROR
1130     K=K-16384                           :REM DELETE DOT
1140     POKE( P+S, M)                       :REM INSERT ONE MARK
1150     POKE( P+256+S, M)
1160     PRINT S;" = ";M
1170     POKE( P+M, S+1)                     :REM RETURN TO SPACE
1180     POKE( P+256+M, S+1)
1190     PRINT TAB(10);M;" = ";S+1
1200     S=S+1                               :REM UPDATE POINTERS
1210     M=M+1
1220     K=K*4                               :REM SHIFT MORSE CODE LEFT 2 BITS
1230     GOTO 870                            :REM AND REPEAT

1240     REM LETTER SPACE

1250     FOR J=1 TO 4
1260         IF S>125 GOTO 1340              :REM ERROR
1270         POKE( P+S, S+1)                 :REM POKE A SPACE
1280         POKE( P+256+S, S+1)
1290         PRINT S;" = ";S+1
1300         S=S+1                           :REM UPDATE POINTER
1310     NEXT J
1320 NEXT I
1330 END
1340 PRINT "MESSAGE TOO LONG"
1350 STOP
```

Program listing to generate ROM program for the CW identifier.

other ROMs that could be used. For instance, if only a single message is needed, the MM5204Q 512×8 EPROM would fill the bill nicely. If you don't anticipate making changes, then a non-erasable PROM would also work. In a pinch, a pair of 256×8 PROMs could be used, too.

Even if you do not have a programmer, many EPROM suppliers have programming facilities. Occasional ads from various individuals in the classified columns of computer magazines also offer EPROM programming.

Construction

Building the CW identifier is easy; the circuitry works at a fairly slow speed and no special precautions are needed in building it. Wire-wrapped construction would be fairly easy and very compact, but if you use one of the 2704/2708/2716/2758 series of EPROMs, then the printed circuit layout of Fig. 11 is for you. (Etched and drilled PC boards are available from Star-Kits, PO Box 209, Mt. Kisco NY 10549, for $15. Also available is 2708 and 2716 EPROM programming for $10; you supply the EPROM and the call.)

Fig. 12 is the parts layout for this board. Since this board is usable with any of the four EPROMs shown in Fig. 10, connections to pins 19 and 21 are brought out to pads and require some care on your part.

Though the circuit board layout is designed for the CW identifier, with a few minor trace cuts it could also be used for the touch-tone sequence detector or for many other micro-programmed sequential controllers. So keep this idea in mind next time you need a controller for some project. It's a winner! ■

Richard Phenix
73 Magazine Staff

Messages from Station Charlie

—when wireless meant life or death

Author's Note: Much is written about transmitters, receivers, antennas, and all the hardware and software of the world of radio. Less is written about the messages made possible by them. This is natural when a W1 writes with pride about his brand-new Superbang 42X and his QSO with a ZL via SSTV on 10.5 GHz using bedsprings for an antenna. We *know* what *his* message is: *"I am using a Superbang 42X with bedsprings for my antenna. . ."* ● There are times, however, when *messages* are the real point—as in the cases of emergencies and disasters. And certainly it was one of those times at Station Charlie, where messages helped win the big war and kept alive the courage and hopes of men and women in the most desperately lonely of personal wars—those fought by secret agents. ● Some names, places, and times have been changed, but this is a true story. ● Many thanks, for their help with technical information, to George Fogarty (ex-W2LHC, ex-JA2AD), Stan Willard W9JAS (ex-W9GSE), and Ed Clinton W8STP—formerly Technical Maintenance Officer, Chief Signalmaster, and Signalmaster, respectively, for Station Charlie. ● This material has been reviewed for security by the Central Intelligence Agency and the National Security Agency. ● Copyright 1981, Richard Phenix: All rights reserved.

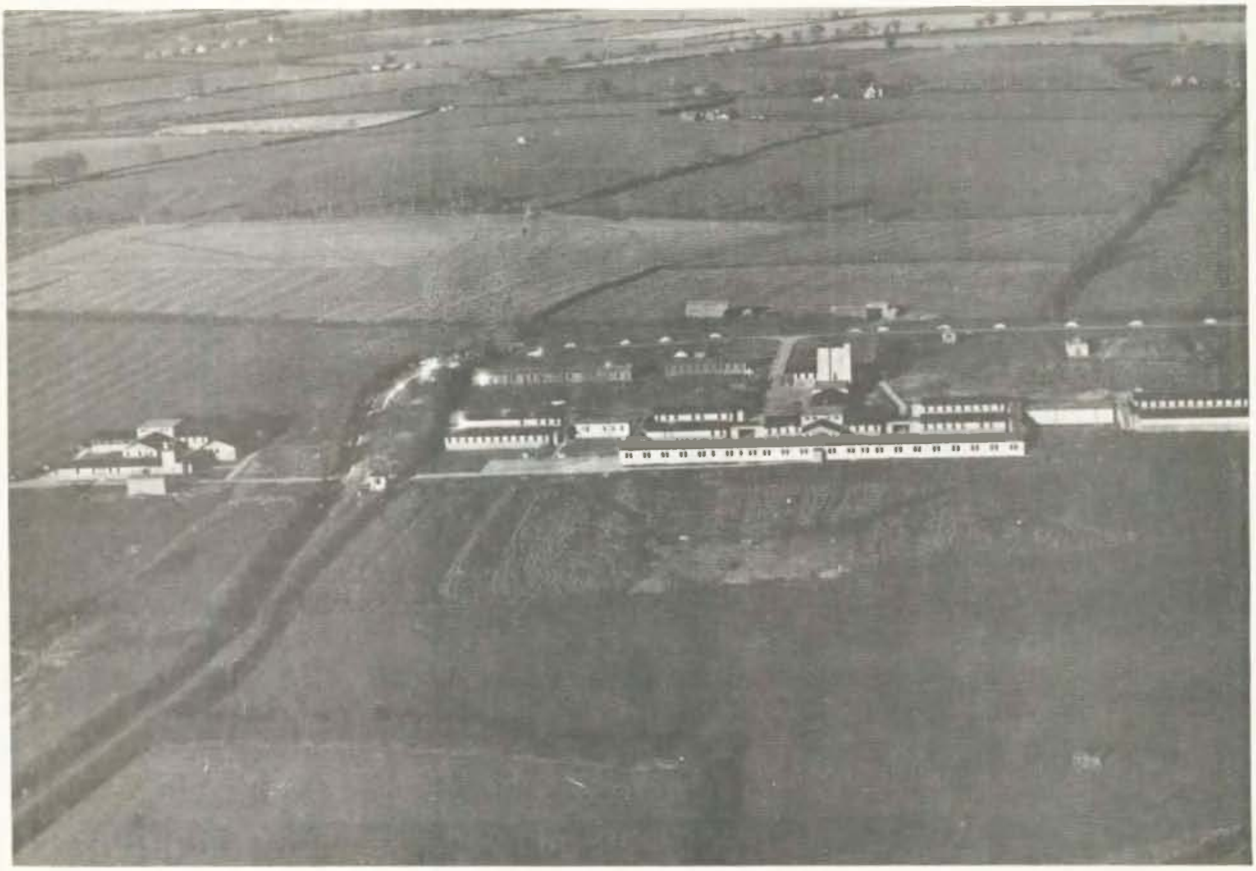


Photo A. Station Charlie, Buckinghamshire, England, 1944.

It is 1944. Station Charlie covers the top of a low, rolling hill in Buckinghamshire, England, not very far from Oxford (Photo A). The station's operations buildings, which make up the "security area," are clustered together at one end of the encampment apart from the rest. Here are housed the communications activities, running 24 hours a day; they are the reason for Station Charlie's existence.

Between them and the "housekeeping area" of mess hall, motor pool, administration buildings, officers' and "other ranks'" barracks, runs an old country lane, now closed to public use for the duration by guard posts at Charlie's boundaries, much to the annoyance of the local fox-hunting club. The lane runs from nowhere in particular at one end to the Sow and Pigs pub at the other, in the small village of Poundon. It is possible for perhaps thirty people to be in the pub at the same time—if they watch out for each others' elbows.

But the some fifty men and women working in the operations buildings are too busy to worry about that, and the three hundred or so in the rest of the camp are either sleeping or about to sleep or waiting to go on duty. Station Charlie is an isolated post and, anyway, the job's the thing.

In fields beyond the operations buildings, receiving antennas lift their slender, quadruple-guyed wands 120 feet into the air; a few miles away, lines of equally-tall transmitting antennas march across other fields in the directions of France and the Scandinavian peninsula (Photo B).

One of several stations operated jointly by American and British intelligence agencies, Station Charlie is, in this critical year of World War II, a communications base for secret agents inside Axis-dominated territories. It is receiving their often-faint Morse signals, deciphering and decoding the messages, and transmitting them by teleprinter to London. It also is encoding and enciphering teleprinted answers or questions from SHAEF (Supreme Headquarters, Allied Expeditionary Force) received over the same secure land lines and is sending them booming out over the English Channel and the North Sea to, it is fervently hoped, alive and receptive ears (see Fig. 1).

The Station At Work

Little was spared to make Station Charlie a reliable link in the communications chains leading from its assigned men and women in the field—close to 100 at times (the "outstations")—to the guarded offices of war planners. There was no James Bond atmosphere at Charlie; we left that to the masterminds behind unmarked and inaccessible doors on London's Baker Street. Our job was to listen for even the faintest whispers of signals, to hear them *at once*, to copy them without error *the first time around*, and to allow the vulnerable senders to get the hell off the air *quickly*; then to translate Morse code groups into clear text in one or another readable language *quickly*, and fire them off to London *quickly*; it was to encipher clear texts from London accurately and *quickly*, to send code groups with copperplate hand *fast*, but not too fast, and, again, to get the hell off the air. (See Photo C.)

Speed and accuracy. It was our job to provide both. Sitting comfortably on our hilltop, safe and well-fed in the peaceful rolling countryside, speed and accuracy were the priceless contributions we

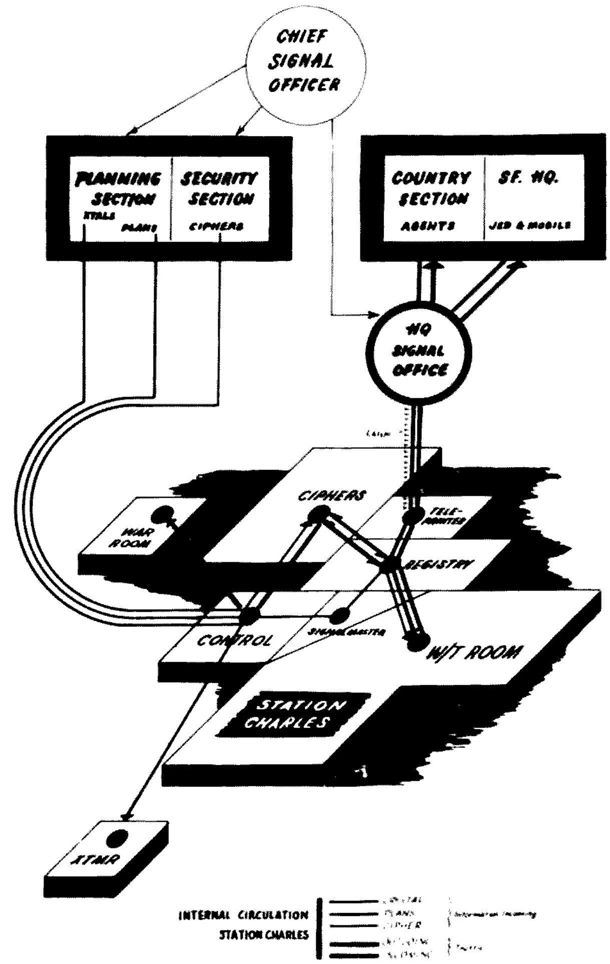


Fig. 1. Operational layout of Station Charlie. British terms are used (W/T—wireless telegraphy, for radio, etc.). "Plans" included calls and schedules (skeds) for transmissions. Agent messages were routed to "country" intelligence offices (Norway, France, etc.) and/or to S.F. (Special Forces) offices during pre- and post-invasion weeks.

Photo B. Transmitting antennas.

Photo C. *A corner of the W/T Room. Agent schedules are posted on the blackboard. The Signalmaster's office behind glass at the rear could monitor any operator position.*

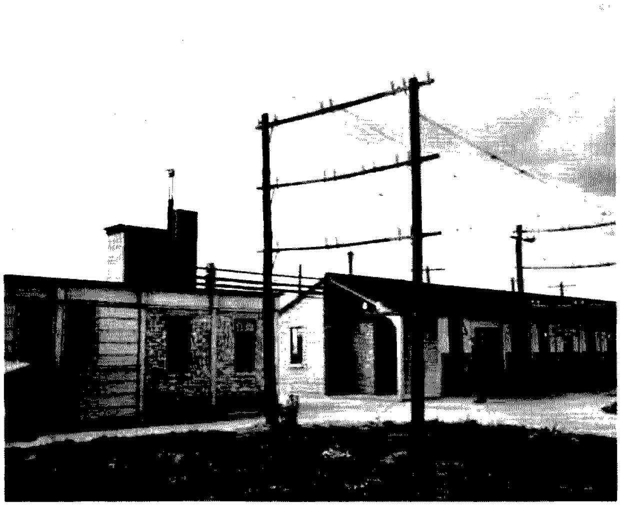


Photo D. Transmitter Building.

could make to those out in the dangerous occupied areas who rarely could provide either; they sometimes died because they could not.

Equipment

It was to preserve lives as well as to make possible the gathering of the highest class of intelligence that the best-available equipment was used. Receivers were the kind that most prewar amateurs wanted and few could afford. There were AR-88s, two kinds of Hallicrafters rigs, the Hammarlund HQ-120X, and National HRO-5s. Recording equipment was by Creed—beautifully-made British units. (This also was used to "fingerprint" agents for comparison purposes in cases where later it was suspected that the Germans had captured an agent and were using his equipment to try to send us misleading information.)

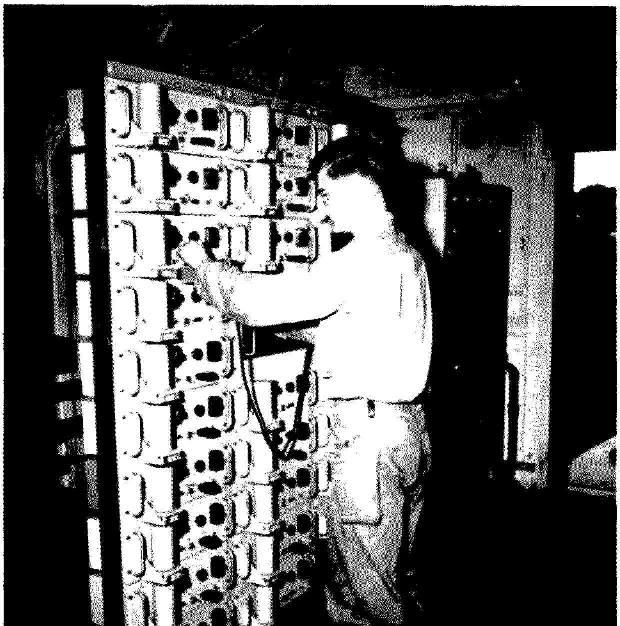


Photo E. The wideband amplifiers were a technical curiosity at Station Charlie, as described in the text.

Good receiving units were essential if transmissions from the field were to be picked up with any reliability. While the equipment of the agents ranged from bulky hand-cranked-generator sets to the then-amazing British fibre-suitcase units, it was mostly the latter Charlie listened for. These measured 12" × 18" × 5" and contained the transmitter, receiver, and power pack with built-in battery charger! The battery was a 6-volt motorcycle type with vibrator high-voltage supply.

Charging was *never* done while transmitting—that was an invitation to German DF units to join the party! All the Germans had to do—and did, in early days—was to cut power to an area, sector by sector, briefly, until transmissions were interrupted, and then move in fast to encircle the sector pinpointed.

Transmitters, located in separate buildings a few miles away (Photo D) and connected through land lines to the Control Room, included a 400-Watt RCA, 3-to-5-MHz unit, using 807 crystal oscillators and 813s in the output stage (probably ET4036s). Tape-sending equipment was principally McElroy—the prewar code-speed champion and manufacturers of speed keys—and also Creed and Teletype™.

The RCA transmitter was hellaciously hard on crystals, and one modification made at Charlie was the addition of low-power crystal oscillator doublers ahead of the 807. (Some parts were obtained in typical war-time fashion by fast shuffles—there may still be an American power mower used to cut English grass on the grounds of a now-retired British officer who helped us out.)

A particularly interesting unit was the wideband amplifier (Photo E) of which we had two. Designed and built by the British, each consisted of ten reasonably conventional low-power, crystal-controlled exciter stages, all fed into a wideband rf amplifier; sixteen or twenty 807s in push-pull parallel kept the input and

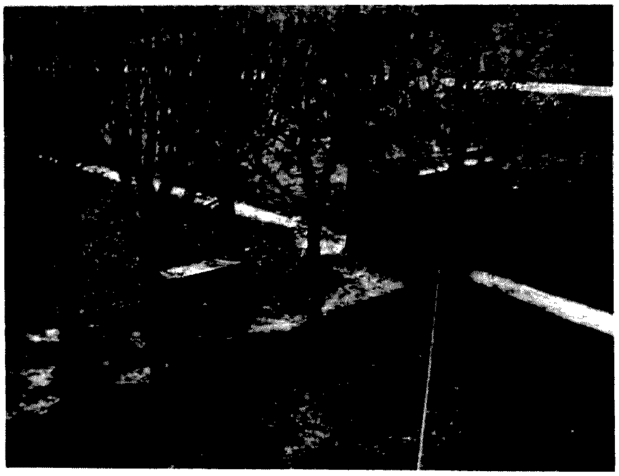


Photo F. One of the mobile units (an SCR-399) at St. Cloud, outside of Paris.

Photo G. The Cipher Room's small war map of France, with Jed locations indicated by map pins along and beyond fighting fronts. The pin nearest the map's center is close to Chateauroux and probably was for Hamish (see text).

output impedance low. (And the efficiency—about 50 Watts per channel!) Thus, coax could feed the input and the output could go directly into terminated rhombic antennas (about 300 feet on a side) pointed in the right direction. Because of the power gain of the rhombics, the effective power per channel was 350 Watts.

Transmitting antennas were mostly delta-matched doublets on poles 60 to 120 feet in height. Station Charlie crews *often* took these down and altered them to conform to changes in transmitter operating frequencies and outstation locations!

Receiving antennas were coaxially-fed doublets patched into individual receivers or, via a vacuum-tube isolation amplifier, to groups of receivers.

The Agents

Station Charlie's special task was to work with, first, agents in Scandinavian countries (our "Country Section"—see Fig. 1), second, with the Jedburghs (Jeds), agents parachuted in ahead of invading forces, and, third, with mobile stations which moved with various army units (Photo F). During invasion days and the weeks following, Jed intelligence was hotlined to the armies, giving them remarkably up-to-date information on what lay immediately ahead. The map in Photo G shows the locations of Jeds geographically and with respect to Allied forces and French resistance groups. (At the time of this photo, the Allies had penetrated well into France, leaving the northwest area clear of Jeds. Those who had been overrun were returned to England—if they had survived—and were readied for other parachute drops.)

Each outstation had its own codes, crystals, transmission "skeds" (see blackboard in Photo C), and secret security checks. The absence of the last in any message was supposed to alert us that the agent had been compromised—that it was the enemy now using the codes and equipment. While both sides had some successes in this sort of counterintelligence, usually the absence of the check was due to forgetfulness or the great pressures under which agents worked in the field, leading them to bare-bones operations—and to hell with procedures.

Those pressures were sometimes so unbelievably extreme that it seemed almost miraculous when things worked out reasonably according to plan. Parachute drops could miss the right area entirely, suitcase transceivers could bounce shatteringly off rocks (or go "glub" in a lake), the local reception committee might not be there but a German unit just might be, leading to an abandonment of all equipment and (hopefully) a headlong dash to escape. Sometimes it was up to us at Charlie to try to sort out what had happened when the wrong agent came in on a sked or somebody else's code was used in an emergency.

One French agent I met in Paris later in 1944 told me of his months in the Ardennes forest in 1943 and 1944. Regularly on the jump, he said—swimming rivers "while the Boche fired at me" (and once escaping in an empty wine barrel on a friendly farmer's cart)—*Citron* spoke with dry humor of times when he figured that even his friends were against him: winter clothes parachuted to him in July . . . one supply drop which consisted of four canisters containing nothing but lampshades . . . and a day when an urgently-important operational message was due from England and, despite German activity near his hideout, he kept his radio sked and received just one message, saying (roughly): *After due consideration, our staff has concluded that the Maquis group you are with should be named after the French -th Regiment that fought in your area.*

Citron also told of the intensely emotional experience of his first radio contact after jumping into France (he worked a sister station of Charlie's). This backed up what we had been told by the Chief Signal Officer (London) about our own agents—that the first contact with us was universally reported to bring an emotional high unsurpassed by any they experienced thereafter. We all believed this, at Station Charlie, and it gave us additional motivation to do our jobs well, but for me it may not have been until ten years later that the *full* meaning became clear—when I had occasion to hear from another agent about the magic of that first contact.

	A	B	C	D	E	F	G	H	I	J
A	a M	a Z	a T	a J	a I	a I	a V	a A	a E	a D
B	b S	b N	b Z	b F	b M	b O	b Y	b H	b J	b I
C	c G	c H	c S	c E	c D	c Z	c A	c B	c B	c M
D	d H	d U	d Y	d V	d Z	d I	d S	d A	d F	d W
E	e E	e X	e R	e I	e A	e Y	e X	e F	e D	e Y
F	f A	f K	f H	f Z	f E	f Z	f C	f M	f A	f J
G	g Q	g M	g X	g I	g K	g L	g E	g D	g D	g P
H	h K	h R	h B	h E	h H	h B	h C	h U	h K	h Q
I	i L	i M	i T	i G	i O	i R	i G	i L	i S	i F
J	j U	j Z	j P	j N	j L	j P	j R	j O	j U	j X

etc.

Fig. 2. The one-time pad ciphering table (E over d equals Z, etc.). Agents' copies were printed on handkerchief-size pieces of silk. The plan was to do it in invisible ink, to be developed in the field in plain water in which chemically-treated shoelaces were to be soaked. I suspect this was just one of those dramatic notions never carried out. The table itself was not secret, and a handkerchief made of silk would all by itself have alerted any German.

(a) EBDAD BJCGH CBGAB EBHFA
(b) DDFJE JBBBB DCEHE GAIFI
(c) ZUZU IZIZYH YHXKX KZLZL

(a) AAAID GFBEC EHDDI JGBEC
(b) AFGJG DDBEE FDJCA ACHBC
(c) MAQUI SINAR EANEE DARMS

ZUZU—Take meaning (of next code group) up to and including word after fifth hyphen.

IZIZ—Infiltration-completed-into-area-occupied-by-enemy

YHYH—700 and

XKXK—50

ZLZL—Continue spelling for rest of message.

Fig. 3. The received message (line a) written over lines in our copy of the agent's one-time pad (his pad pages were burned as he used them) was deciphered by use of the table in Fig. 2. Line c then was decoded using the table shown in Photo I, excerpts from which are listed here.

Swan

"Oh, how many tears I fell that day!" was the way *Swan* expressed herself to me on that occasion—near the end of the few days I ever knew her as more than just a code name. The radio operator for one of the Norwegian units (all of which were known by bird names), much of her war had been spent in the Stavanger area. For a week after her unit was activated, she had been unable to contact Charlie. Then, in a saeter, much higher up above a small fjord than she had been before, tired, discouraged, wet, hungry, and fearful of the German occupation forces—for they surely knew by then that her team was in the vicinity—she tuned in on her assigned frequency at her assigned time and in came the booming signal from Station Charlie: STW STW STW de CAM CAM CAM QRK? QRK? QTC QTC K K repeated over and over as the perforated-tape loop (Photo H) fed through and our W/T operator strained his ears anxiously for the response: CAM de STW QRK . . .

Photo H. The Perforator Room, in Registry, stored the tape loops with the agents' calls. Perforated tape was state-of-the-art in 1944. We had some of the earliest belt recorders, but they were a total loss at that time.

I like to think that I remember that day, 37 years ago, and maybe I do. I know I told *Swan* that I did—and meant it—but at Charlie we had many such happy first contacts with agents, whereas for *Swan* it was, of course, the only one, and tears glistened on her cheeks again as she relived it.

"You were all we had," she said. "My God, that feeling of *not* being alone after all! We got our courage back . . . you [Station Charlie] were *there*, and you never let us down!"

So far as we could know, Station Charlie never let anyone down. There was a set period of time for listening for an agent to keep a sked, at the end of which the pragmatic assumption was that he was blown—dead or captured—and we could stop sending out our call on a listening watch. Somehow, however, we did not stop unless we had other intelligence that the agent was, indeed, lost. The Charlie W/T operators hated to give up, and it was well understood when some of them used off-shift hours to listen for signals which usually never came.

Hamish

Hamish was one of the Jeds who failed to keep a sked one day. According to the location of his pin on the war map in the Cipher Room (see Photo G), he was operating in a particularly hot area. (This map was backed up by very large-scale maps to help us decipher garbled transmissions which often included critically-important place names. Thus, we could advise London that "German tanks massing at Chatsauvyhf" undoubtedly referred to Chateauroux, not Chateauneuf, which was more than 100 air miles away from the agent's location.)

As with other agents we presumed were lost, Station Charlie kept *Hamish* "alive" beyond the required period.

I don't remember what it was that made *Hamish* special to me, but he was, and I know that he was particularly in my mind some years later when I met and chatted with a German whose war job had been DFing Allied clandestine transmissions in the Chateauroux area; he told me with pride of some of the successes his unit had enjoyed. But I never mentioned *Hamish*—or Station Charlie—to him.

The Cipher Section

The W/T link was not the only one which broke on occasion. It happened sometimes that a message came in which could not be deciphered. We hated to ask outstations to expose themselves to DFing by repeating transmissions, but when one had come in five by nine that wouldn't break, we could be sure that the trouble was in the ciphering process.

That sort of trouble belonged to my department, the Cipher Section. As the Signalmasters felt about their operators, so I felt about the cipher crew. I couldn't ever say enough in praise for the more than a hundred service men and women who worked the Cipher Room. Most were members of a British women's auxiliary—a famous one dating back to the Boer War. Mostly English or Scots, many had good personal reasons for dedication to the job: husbands, family members, and friends who were out there somewhere or who had already died in combat or in air raids. A few of them had *memorized* the deciphering table for the one-time-pad cipher system—this consisted of 676 three-letter combinations! (Fig. 2 is of a made-up portion of such a table, showing only 100 of the three-letter combinations.)

Given a priority message hot from the W/T room—line (a) in Fig. 3—and the correct copy of the one-time pad (page after page of random 5-letter groups) on which the agent had enciphered his message—line (b)—there was usually someone on duty who could write the first over the second and come up with the clear text—line (c)—without looking at the table. (Portions of the clear text sometimes were also in code—as in the Fig. 3 example—and had to be decoded using another table, part of which is shown in Photo I; nobody ever even tried to memorize that one, which yielded thousands of meanings from its four-letter code-group combinations from AAAA through ABAB through ZYZY to ZZZZ!)

We also had specialists who made possible the untangling of messages which came in not only in a language other than English but also via the horribly complicated double-transposition ciphering system used by Scandinavian agents. Based on a memorized key, it had obvious security advantages over code books and tables, but it worked satisfactorily only when, well, only when it worked satisfactorily! Unlike the one-time pad system where each letter was, in effect, independently enciphered by the substitution of another letter, in this system all the letters remained themselves but were by prearrangement twice transposed in their relationships with each other—jumbled about, in other words.

In the worst case, one single misplaced or misnumbered letter in the key could make a stew of an entire message. Fig. 4 shows an example of a message correctly enciphered—(a), (b), and (c)—and also, in (d), (e), and (f), what can happen during deciphering when only seven letters had been transposed incorrectly. (Fig. 5 is the poem used as the key in this example. It is one that I wrote for myself in 1943 when I thought I was going into North Africa with a team; I shall never be able to decide whether I am glad

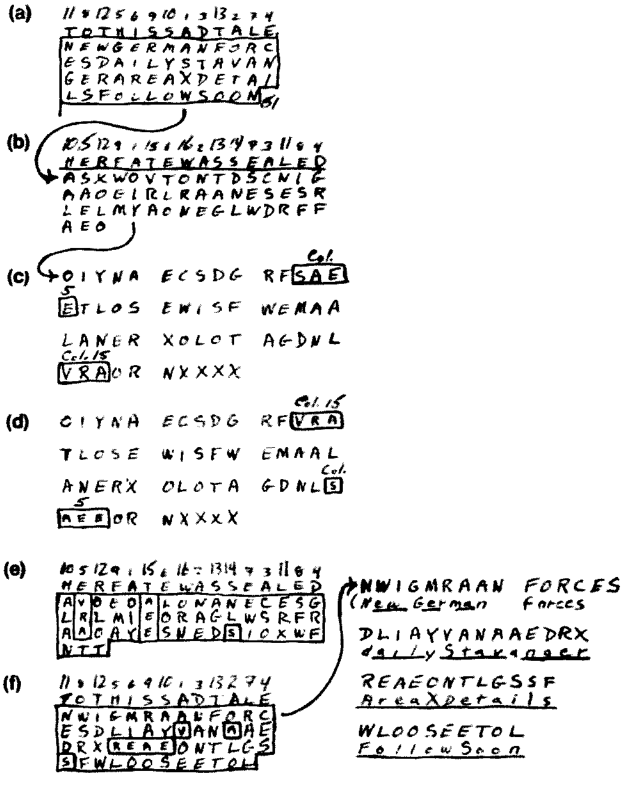
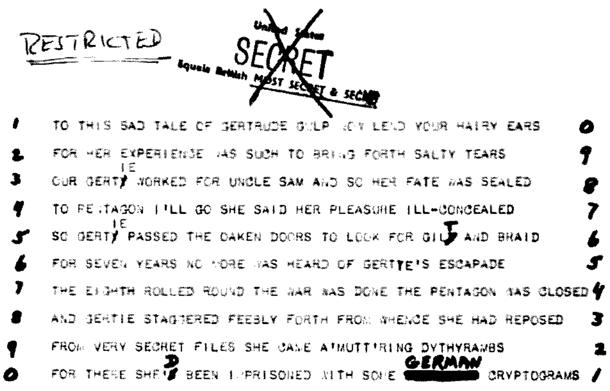


Fig. 4. This shows how an agent enciphered his message number 18 (using, therefore, in a prearranged way, lines 1 and 8 of his memorized poem—see Fig. 5). Note in the second box (b) how sloppy writing of column numbers 5 and 15 could result in misplacing seven letters: (c) is correct; (d) is wrong, resulting in garbled deciphering in (e) and (f) and the thoroughly loused-up result (capital letters). The misplaced letters are boxed here to show how they moved around. This type of error happened to be ho-hum common and gave our experts no problems!


RESTRICTED

United States SECRET Equals British MOST SECRET & SECRET

1 TO THIS SAD TALE OF GERTRUDE GULP NOW LEND YOUR HAIRY EARS 0
2 FOR HER EXPERIENCE WAS SUCH TO BRING FORTH SALTY TEARS 9
3 OUR GERTIE WORKED FOR UNCLE SAM AND SO HER FATE WAS SEALED 8
4 TO PENTAGON I'LL GO SHE SAID HER PLEASURE ILL-CONCEALED 7
5 SO GERTIE PASSED THE OAKEN DOORS TO LOOK FOR GILT AND BRAID 6
6 FOR SEVEN YEARS NO MORE WAS HEARD OF GERTIE'S ESCAPADE 5
7 THE EIGHTH ROLLED ROUND THE WAR WAS DONE THE PENTAGON WAS CLOSED 4
8 AND GERTIE STAGGERED FEEBLY FORTH FROM WHENCE SHE HAD REPOSED 3
9 FROM VERY SECRET FILES SHE CAME A'MUTT'RING DYTHYRAMBS 2
0 FOR THERE SHE'D BEEN IMPRISONED WITH SOME GERMAN [redacted] CRYPTOGRAMS 1

Fig. 5. My own poem (obviously), used only once to check it out. Yes, dythyrambs is spelled wrong; but I've always been sorry for people who have so little imagination that they can spell a word only one way (so said Mark Twain).

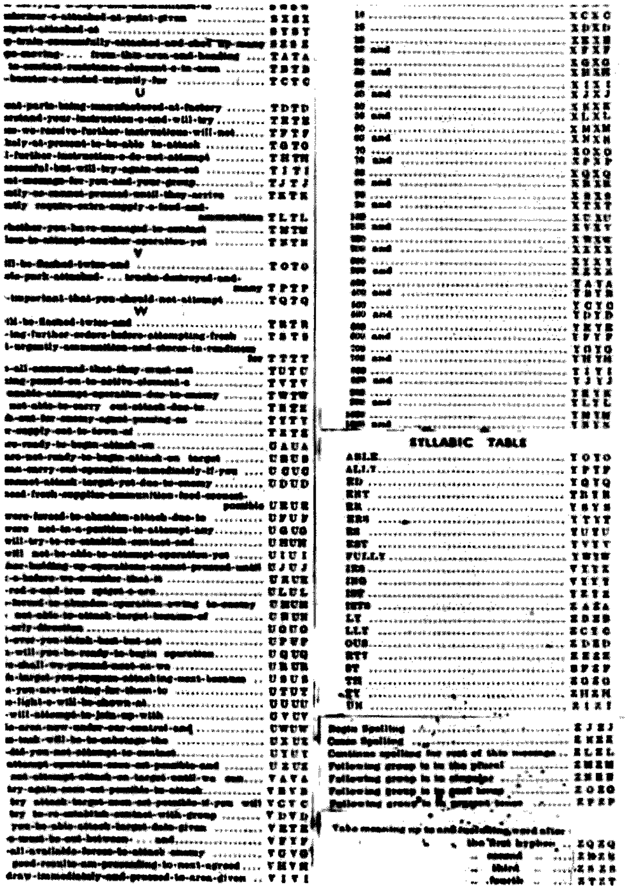


Photo I. Part of the code table used by Jeds. This was another refinement that was more accurately thought of as a complication. Designed to shorten messages and, therefore, precious transmission time, agents usually chose to risk longer times on the air in favor of shorter times for the enciphering process.

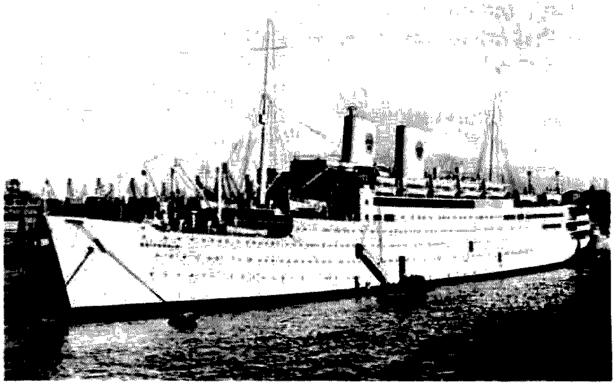


Photo J. The Motor Ship Gripsholm *of the Swedish-American Line was famous for her many mercy and diplomatic voyages. She later became the* Berlin *for the North German Lloyd Line.*

or sad that that assignment was changed!)

Visualize, if you can, *Swan* sitting in a leaky saeter hut with stub of pencil and soggy paper, half-frozen, remembering her own poem—was it *imorgen* or *imorgon?* (one being Norwegian and the other Swedish, for "tomorrow")—remembering whether it was message 17 or 18 (which determined which lines of the poem to use), constructing her squares, numbering the columns (the first a is 1, the second is 2; the third, 3; no b or c, so d is 4, etc.), writing directions to a safe house for a new agent soon to be parachuted in (GA FEMTE GATE TIL VENSTRE OG DEN SJETTE TIL HØIRE), removing the letters vertically from the first square in column-numbered order and writing them horizontally in the second square, removing them again, vertically and so on, all the time listening for the always-to-be-feared sound of approaching German DFing units. *Swan* did her work correctly for the most part. I couldn't have! Could you?

Add to that all transmission problems, QRM, QRN, etc., and it was a wonder that we managed to untangle (*without* computers) nearly all the "undecipherables." And that included one which took a score of us weeks to break—and earned us a commendation even though it turned out to say the war-time equivalent of something like "Having wonderful time, wish you were here." After all, it *could* have been important!

It is a temptation to write on and on about the little corner of the war which was Station Charlie and the messages we sent and received, but by now you should have the picture of intensely dedicated W/T operators, cipher personnel, transmitter technicians, controllers, perforators, teleprinter operators, registry clerks, and maintenance technicians, all of us so awfully tenuously linked to the lonely souls to whom our work literally could mean the difference between their eventual return to England—and living—and capture, possible torture, and death.

Ten Years Later

It is 1954. The M/S *Gripsholm* (Photo J) is plowing her slow and steady way through the Atlantic. Fine on the starboard bow is Dunnet Head at the tip of Scotland, around which is the North Sea—one of the most crowded of graveyards for ships of war. The *Gripsholm* is headed for Gothenburg, Sweden, and then the port of Bremerhaven, Germany.

It is the dawn watch, and Second Officer Kurt von Meeteren is on the bridge; Acting QM Ernst Weiss has the wheel (Photo K). Von Meeteren was commander of the German submarine U399 for part of the war, and then of U3021, which, on command at the end of the war, he scuttled in the North Sea. Also on watch is another Quartermaster, a bosun's mate, and two ABs—one on lookout in the foremast and one on fire guard.

Throughout the ship, men once of the German Navy are on duty, for this is a hand-picked crew: It is the maiden voyage of the *Gripsholm* under charter from the Swedish-American Line by Norddeutscher Lloyd; it is the first passenger ship since WW II to fly the German flag.

Most of the passengers, however, are Scandinavian, and they had not been told that the only Swede on ship duty would be the Chief Engineer, Eric Toll. It is a difficult experience for many of them—bitterly so, for some—because the war is not that far in the past and no part of it has been forgotten. The German crew is aware of this—it was their war, too, and they were defeated—and members are keeping as low a profile as possible under the circumstances. It is *not* a happy ship.

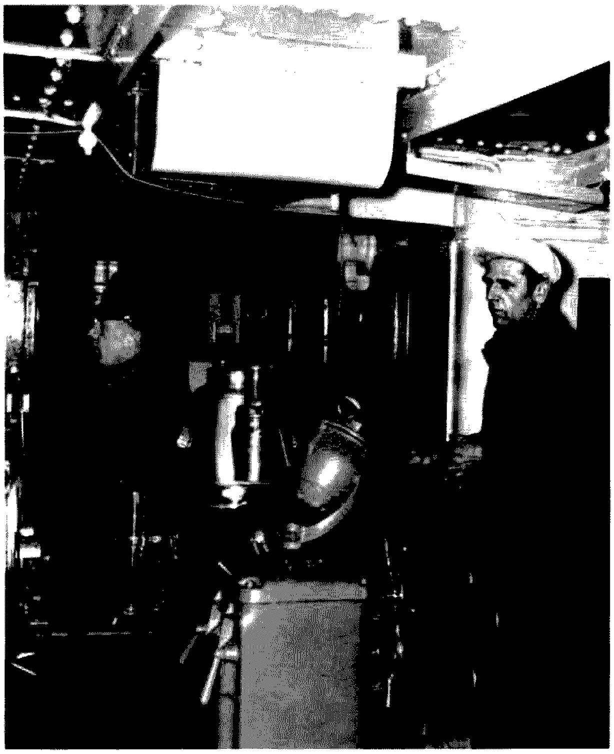


Photo K. On the bridge of the Gripsholm, *2nd Officer Kurt von Meeteren stands the dawn watch, with Acting QM Ernst Weiss at the wheel.*

Photo L. Chief Radio Operator Hans Kleiber in the Gripsholm's *radio shack.*

At this pre-dawn hour, most of the passengers are in their staterooms for the night, forgetting in sleep the German presence that they had been trying to ignore during the day. Some, however, are still up and enjoying each other's company. There is one such group in particular, in one corner of a tourist-class lounge—a Finn, three Swedes, two Norwegians, a Dane, and an American. As a sort of goodnight salute to each other, they are singing their national anthems, one by one. All of them know them all—except for the American. He knows only his and is feeling rather sad about that.

Four Who Were There

One. I was the American and was on my way to Frankfurt, Germany, to be a consultant for a refugee program. By day, I "worked" with the German officers and men, for I had been given the run of the ship in order to write a story about the *Gripsholm.* (By night, I "played" with my fellow passengers.)

Two. Thus, I had met and interviewed Chief Radio Operator Hans Kleiber (Photo L) who told me of his DFing of Allied agents in France; it was then that I had wondered about *Hamish.* Could Kleiber's unit have been responsible for his disappearance?

Three. Four. And I wondered even more—but *only* to myself (and *never,* before now, to more than a very few)—when, after trying to sing Scandinavian national anthems and joining in on what was supposed to be the last skoal of a joyous night, two of my favorite people there, Christi and Dag, turned out to be *Swan* and *Hamish.*

Never before nor since has there been such a moment in my life.

During the hours we had spent together on board, we had gradually come to know each other, of course, and, as reserves had dropped away, we had talked more and more about the war years and our very personal experiences. I do not remember exactly how the final recognition came about. I never will; it overwhelmed us all too suddenly. We were talking about Norwegian resistance groups, I know, and I think Christi said something like "... when I was with *Swan* ..." and I know my jaw dropped. I managed to say some strangled words about Station Charlie ... Christi looked at me incredulously ... Dag said something like "Oh, my God!" ... and then, "I'm Hamish ...! and I said, "Oh, my God!"... and the three of us began talking, laughing, and, oh, yes, crying, all at the same time ... and Dag ripped off his shirt and showed us his scarred back where the Gestapo had had him flayed ... after he'd been DFed by the Germans ... and Christi told us of her very first contact with Station Charlie, and she said, *"Oh, how many tears I fell that day ... !"*

Conclusion

Yes! Sometimes the messages *are* the most important part of radio communications, amateur or otherwise. And the sounds of such communications can echo down through the years, forever.

I doubt if any of us from Station Charlie can hear Morse code now without remembering, and being grateful for, the small and quiet roles we were privileged to play in those great happenings of WW II, when there were more of the world's people than ever before or since united in a shared belief. ■

Carl C. Drumeller W5JJ
5824 NW 58
Warr Acres OK 73122

The Great Compromiser

—Henry Clay, eat your heart out

The search for better antennas has been going on ever since Hertz made his original experiments. He, incidentally, came up with findings that many people think were not known until many decades later. In fact, very few new facts relating to antennas have been discovered in the past 75 years; even fewer in the past 50 years. That doesn't mean, however, that the wheel has not been reinvented countless times!

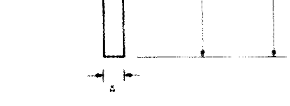


Fig. 1. Wideband doublet antenna (not to scale). Design example: lowest operating frequency—7 MHz; range—7-21 MHz; A = 42.6 cm (1.4'); B = 14.3 m (46.5'); resistor—600-Ohm noninductive. For transmitter power output of 100 Watts, use at least 60 Watts dissipation.

Of late, there has been a resurgence of interest in a type of antenna often used by military stations during the Hitler War. It was desirable because it avoided losses attendant to the use of Marconi-type antennas. Marconis, unless used in conjunction with excellent ground systems, have an inherent loss that sometimes is unacceptable. This led to research for a system that would avoid such ground losses. The task was further complicated by the fact that military high-frequency communication often was required to operate over a wide range of the HF spectrum.

To reach an acceptable solution of this complicated problem, an old idea was resurrected from the dustbin, dusted off, and slightly modified to meet the exigencies of the situation. It was not an ideal solution. But, then, just what is perfect?

The slightly-compromised solution was a wideband-terminated doublet. Some persons prefer to call it a "squashed rhombic." It has had a number of other nicknames.

The antenna, as shown in the diagram, is a folded, resistance-terminated doublet, one fed with a 600-Ohm balanced transmission line. The terminating resistor may be either a noninductive resistor, suitably protected from the weather, or a 600-Ohm transmission line constructed of high-resistance wire. Alternatively, one could run a normal-loss 600-Ohm line to a convenient location for the terminating resistor. Because of the fact that the resistor must be capable of dissipating 60% of the rf energy supplied to the antenna, its physical size may make it not practical to mount the resistor directly on the doublet.

The length of the doublet is one-third of a wavelength, and the space between wires is one-hundredth of a wavelength. These two dimensions are for the lowest contemplated operating frequency.

A test of an antenna of this type by the US Navy Electronic Laboratory showed a transmission line standing wave ratio of 1.4 to 2.6 over a frequency range of 4 MHz to 22 MHz. Antenna efficiency varied from approximately 20% to 60% over the quoted range. Peaks in radiation efficiency were noted for frequencies at which the antenna was a quarter wavelength and three-quarters wavelength. Below one-quarter wavelength, the radiation efficiency dropped rapidly, but above that point the efficiency dropped more slowly and reached a minimum at a frequency corresponding to one-half wavelength.

Although the efficiency of the wideband doublet is less at any given frequency than that of a conventional half-wave doublet at its resonant frequency, the advantage of wideband operation may outweigh the loss. Translated into dB drop on a receiver's S-meter, the loss is less impressive!

The directional characteristics of the wideband

doublet are similar to those of a conventional doublet. The antenna may be tilted (that is, mounted as a sloper) to have a radiation pattern more nearly nondirectional. A moment's reflection will show you that a transmission line to a sloper would be much easier to install than one to a vertical.

Note that a balanced feedline is required. It's possible, of course, to use coax feed . . . if you're prepared to design and construct a weatherproof device that'll perform the dual functions of impedance transformation and unbalanced-to-balanced.

The military of both this country and Great Britain made extensive use of this type of antenna, mostly for point-to-point communication circuits.

To sum up, here's what you get: a wideband antenna that'll work moderately well over a broad frequency spectrum. The vswr on the feedline would not be low enough to make a fixed-tune, solid-state transmitter happy, but would be acceptable by almost all transmitters having a tuned output stage. An impedance-matching device with balun functions would be needed to mate the 600-Ohm line to the input of most transmitters. It would work the new bands as well as those presently allocated (with proper design, of course).

Against these advantages, you must weigh these considerations: a drop in radiation efficiency, the necessity of having a terminating resistor, and a feedpoint impedance not compatible to modern transmitters.

You make your choice. ■

Reference

Department of Commerce Circular 513.943, I. June 27. 1949.

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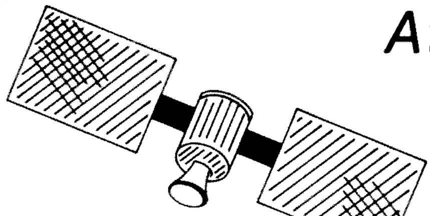

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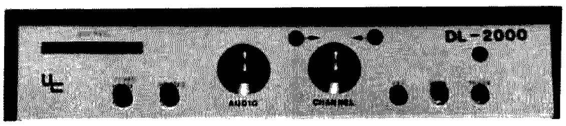

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—cast away darkness

Ash Nallawalla ZL4LM/VK3CIT
53 Chirnside Avenue
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Australia

It was well before 1977 when my friend, Don ZL4DS, designed a synthesized transceiver using BCD thumbwheel switches for direct programming/readout. (That's another story.) A receive-only version, the KR 1000 was built and a prototype, shown in Photo A, was to be sent for evaluation to Arthur Cushen, the famous blind shortwave listener.

Photo A. Direct thumbwheel-switch readout on the prototype KR 1000. (Photo by ZL4LM)

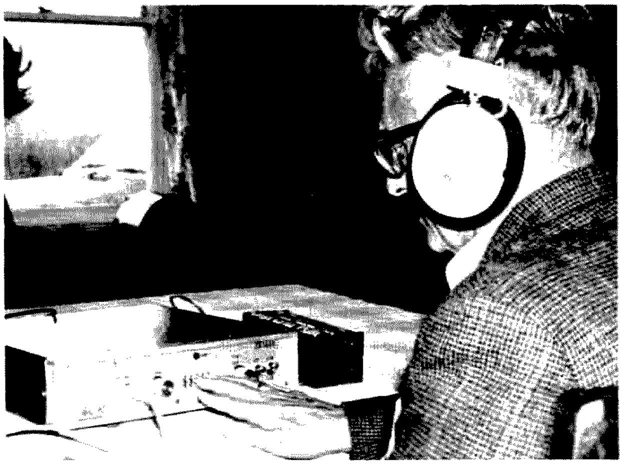

Photo B. Blind SWL Arthur Cushen finding his first station unaided. (Photo by Leo Miezenbeek)

In the past, blind radio amateurs and SWLs have relied mainly on crystal markers or sighted spouses and friends to provide frequency readout. In recent years, several commercial aids have been marketed, but they are not always compatible with existing equipment.

I was to take the KR 1000 to the 1978 annual convention of the New Zealand Radio DX League at Tiwai Point, near Invercargill. I was trying to figure out how Arthur could "tune around" without assistance, when the idea struck me!

How about marking the thumbwheel switches in some way so that Arthur would have a starting point? The easiest method would be to file down or snip off the sharp tip of each thumbwheel switch position corresponding to zero, just enough to make it feel different than the other numbers. (Fig. 1.) A blind person could line up all the zeros and then flick down each switch in turn to arrive at a desired frequency.

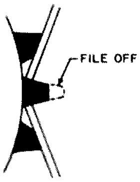

Fig. 1. Modified switch.

Arthur's face lit up when he dialed up his first station (Photo B). "For the first time in many years I have been able to tell the exact frequency of a station without the help of anyone else!" he exclaimed. Later, he wrote about his experience for SWL publications.

In 1978, there were no popular commercial receivers or transceivers (to my knowledge) that used thumbwheel switches, so I did not bother to write this article then. Today, it's a different story. There are several examples around: certain CB-to-10 conversions, Icom IC-2A, AR 240 series (in the US known as Tempo S1/2/5), etc. There must be dozens of non-amateur applications, too.

Even if you are not blind, this simple mod may come in handy if you are caught in the dark or want to demonstrate amateur radio to a blind friend, and perhaps some manufacturer could incorporate the idea as an added feature! ■

Larry Aultman WA4VYR
Rte. 1, Box 166
Sylvester GA 31791

Put Talking Time on Your Repeater

—a Sharp idea

Repeaters everywhere have doodads of every sort, one of which is a time-announcement machine. Historically, these talking clocks were very expensive, bulky, and just plain hard to use. Recently, Sharp (makers of calculators, watches, refrigerators, microwave ovens, and such) introduced a talking clock. This low-priced device sells for about $79 and is just ideal for interfacing to a repeater.

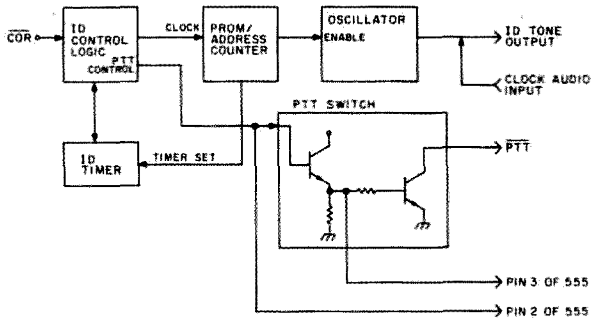

Fig. 1. Talking Time interface.

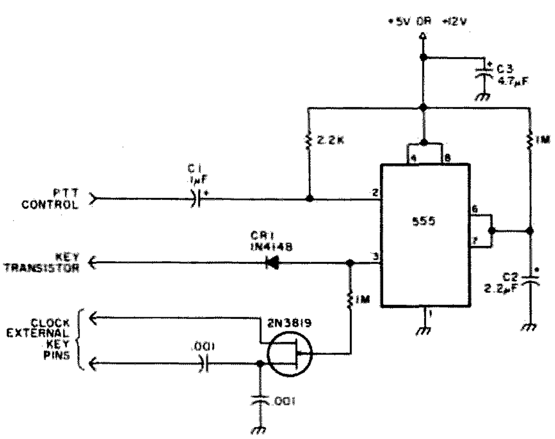

Fig. 2. Clock timer. C1 through C3 are tantalum.

About the Clock

The clock can be found in most discount distribution center catalogs. The model number is CT-660. It is a small electronic clock with a liquid-crystal display (LCD) and a small speaker on the top. The case is plastic with a metal top. All controls are on the bottom in a covered compartment except an auxiliary pushbutton switch which activates the time announcement. Power is furnished by two AA batteries. A mercury-type battery is preferred and will last about a year during normal use, but the life of the batteries will be shortened by high usage of the voice synthesizer.

Setting the time is easy. Just flip open the cover on the back, slide the Time/Alarm switch over to the left, to the Time/Set position. Press the Hour button to set the hour. Then set the minutes in a similar manner. Unlike most electronic clocks, holding the button down does not cause the clock to advance. The clock will announce the hours and minutes as you press the button. After you have the correct time, press the Set button which loads the programmed time into the clock. Failure to press the Set button will result in the time being lost when you return the switch to normal.

The regular time and alarm functions are provided as in any electronic clock, but you have several options. One option is time on the LCD without voice announcement or alarm. A second option is an alarm function that wakes you to a tune; if you fail to rise, it informs you that it is now five minutes later and you are *late*. The last time option is the alarm previously described, plus half-hour and on-the-hour automatic time announcements. Other functions besides time and alarm are talking timers (5 minutes and 30 minutes) for you darkroom people and stopwatch functions for you joggers.

The most interesting thing about the clock is the voice. It is produced by a read only memory (ROM) containing the voice pro-

gram, a digital-to-analog (D/A) converter, and clock/CPU LSI chips. The voice is a digital recording of a male voice. The person whose voice Sharp used to make the ROM recording was very articulate in his enunciation of the words. Although the voice sounds vaguely like the voice of a Cylon Centurion from "Battlestar Galactica," it is very easy to understand. To be fair about it, though, it is not as bad as one might imagine. Matter of fact, it is better than most computer voice synthesizers that I have heard, and the whole thing is only about ¾" high, 2" deep, and 4" wide. It is amazing that it can do so much and be contained in such a small package. It is just the thing to round out your package of bells and whistles on your repeater.

The Connections

Naturally, merely placing the Talking Time atop the repeater cabinet is not all the interfacing required. The problem is to connect the audio from the clock to the repeater and somehow to trigger the voice when you want it to give you the time. On our 146.22/.82 repeater here in Albany (a Motorola Motrac), a couple of us decided that we wanted the time to be announced immediately after the ID.

Fortunately, the clock has very easy hookup points. All that is needed to trigger the voice is a short on the "external key" pins Sharp thoughtfully located on the left side of the case. Audio is brought out by either making a small hole in the case or by soldering wires to the external key pins inside and running all the wires out the hole already in the case. Internal connections consist of: 1) A wire connected to the negative battery terminal; 2) A wire connected to the low side of the speaker; and 3) A wire connected to each of the external key pins.

The only difficult wire to locate is the low side of the speaker. To locate this connection, position the clock with the volume control on your right; with the top off the clock, locate the two speaker wires. I might note at this point that it is somewhat difficult to remove the top cover of the clock. Remove the three screws in the case—one is visible, one is in the battery compartment, and the other is hiding under the cover, which must be totally removed to gain access.

After the screws are out, push out gently on the inside of the battery compartment while pulling up on the top cover to pop it off the plastic tabs. Now notice that near the rear left of the circuit board is a screw that secures the board. There should be several components sandwiched in there *and* the ground wire from the battery terminal. The low speaker wire is the speaker wire nearest the screw. The high speaker wire has next to it a wire that goes across the board to a spot near the volume control. The clock that I had had an extra hole already in the board at the speaker low point and all I had to do was solder a wire in that hole. That is all there is to the clock connections.

The Interface

To make the clock operate the repeater, a small interface had to be constructed. Wishing the time to be announced after the ID meant that a signal from the ID could start the time sequence. Not wanting to make major changes in the ID unit itself, I decided that the already existing PTT signal could be used as a trigger for the clock. In our ID unit, there is a line which goes high (+5 V dc) and turns on the keying transistor. This transistor, in turn, turns on the actual PTT transistor. Refer to Fig. 1. When the line is high, the repeater is keyed.

The simplest way to trigger the voice was to build up a 555 timer which is activated by the line going back low—which only happens after the ID. The 555 timer is set so that it is active for only as long as it takes for the time to be announced. See Fig. 2 for the schematic of the timer circuit.

How It Works

The negative transition of the ID PTT line from high to a low is coupled across C1, producing a negative-going spike. This spike triggers the 555 timer. Pin 3 of the timer goes to a high value. This high is coupled through CR1 to the base of your keying transistor to key your repeater. (The 555 timer can source 200 mA of current, so added drive should not be necessary.) Also connected to pin 3 through a 1-megohm resistor is an FET switch. The two wires from the external key should be connected as shown. At the same time that the repeater is keyed, the Talking Time is triggered by the FET switch. Audio is injected at the output of the ID unit and the volume control adjusted to control the level of the voice.

Conclusion

Get your club to get a Talking Time and add time to your repeater. It is a neat project that can be done in an afternoon without difficulty. I used a PC board but Vectorboard® could be used as well. A service manual is available from Sharp which is quite detailed in its description of the clock, including timing diagrams and a parts list. Have fun with this project! ■

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SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

SOUTH BEND IN
JAN 3

A hamfest swap and shop will be held on Sunday, January 3, 1982, at Century Center, downtown on US 33 one way north between the St. Joseph Bank Building and the river, South Bend IN. Tables are $3.00 each. There is a half acre of carpeted room in the same building as the industrial history museum. Talk-in on .52/.52, .99/.39, .93/.33, .78/.18, .69/.09, and 144.83/145.43. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616, or phone (219)-233-5307.

WEST ALLIS WI
JAN 9

The West Allis RAC will hold its 10th annual all-indoor Mid-winter Swapfest on Saturday, January 9, 1982, beginning at 8:00 am at the Waukesha County Exposition Center. Advance tickets are $2.00 and tickets at the door are $3.00. Reserved 4-foot tables are $3.00, at the door, $2.00, and on the balcony, free. Included with the ticket will be a 50¢ coupon toward a sandwich purchase. Prizes will be awarded. For more information, write 1982 Swapfest, PO Box 1072, Milwaukee WI 53201.

RICHMOND VA
JAN 10

The Richmond Amateur Telecommunications Society will hold its annual Frostfest on Sunday, January 10, 1982, from 8:00 am to 4:00 pm at the Virginia State Fairgrounds, Richmond VA. Admission is $3.00 plus a table charge for exhibitors and flea-market displays. Overnight trailer parking with complete hookups will be available at $7.00 per night. Various prizes will be given away during the day with three main prizes to be awarded at 3:00 pm. There will be approximately one acre of indoor heated and well-lighted space. Talk-in on 146.34/.94, 146.28/.88, and 146.52. For additional information, call Joe Stern W4LD at (804)-737-0333.

OAK PARK MI
JAN 10

The Oak Park Amateur Radio Club, Inc., will hold its annual Swap & Shop on Sunday, January 10, 1982, from 8:00 am to 3:00 pm at the Oak Park High School, at the corner of Oak Park Boulevard and Coolidge Highway, Oak Park MI. Admission is $2.00 per person. Children 12 and under will be admitted free. Activities will include a league table, a door prize drawing, and a raffle for YLs. There will be free parking available as well as food and refreshments. Talk-in on 146.04/.64 and 146.52. For additional information or reservations, send an SASE to Rob Numerick WB8ZPN, 23737 Couzens, Hazel Park MI 48030, or phone (313)-398-3189.

SOUTHFIELD MI
JAN 17

The Southfield High School Amateur Radio Club will hold its annual Swap & Shop on January 17, 1982, from 8:00 am to 3:00 pm at Southfield High School, 24675 Lahser, Southfield MI. Doors will open at 6:00 am for exhibitors. Admission is $2.00. Reserved 8-foot tables are $8.00 each and must be paid for in advance. Tables will also be available at the door. There will be lots of parking, food, and door prizes. For more information and/or reservations, write Robert Younker, Southfield High School, 24675 Lahser, Southfield MI 48034, or phone (313)-354-8210.

STUART FL
JAN 30

The Martin County Amateur Radio Association will hold its annual Picnicfest Hamfest on Saturday, January 30, 1982, from 8:00 am to 3:00 pm at Langford Park, Jensen Beach FL. Admission will be free. There will be picnic areas available and a playground for the children. For further details, contact Vern WA4GQY at (305)-334-6220, Don W4OST at (305)-286-0500, or Mike WA4GUH at (305)-334-6000 or (305)-878-7111.

ARLINGTON HEIGHTS IL
FEB 7

The Wheaton Community Radio Amateurs will hold their annual hamfest on February 7, 1982, beginning at 8:00 am at the Arlington Park Race Track EXPO Center, Arlington Heights IL. Tickets are $3.00 at the entrance and $2.50 in advance. There will be free flea-market tables, expanded floor space, parking, awards, and a large commercial area, including the new computer section. Talk-in on 146.01/.61 and 146.94. For commercial info, call WB9TTE at (312)-766-1684; for general info, call WB9PWM at (312)-629-1427. For tickets, send an SASE to WCRA, PO Box QSL, Wheaton IL 60187.

TRAVERSE CITY MI
FEB 13

The Cherryland Amateur Radio Club will hold its ninth annual Swap 'N Shop on Saturday, February 13, 1982, from 8:00 am through 2:30 pm at the Immaculate Conception Middle School gymnasium, 218 Vine Street, Traverse City MI. General admission is $2.50 and single tables are $3.00. Talk-in on 146.85 and 146.52. For further information, contact Jerry Cermak K8YVU, Chairman, 3905 Slusher Road, Traverse City MI 49684. An SASE will be appreciated.

MARLBORO MA
FEB 14

The Algonquin Amateur Radio Club will hold an electronics flea market on February 14, 1982, at the Marlboro Junior High School cafeteria, Marlboro MA. Sellers will be able to set up from 9:00 am to 10:00 am and doors will be open from 10:00 am until 2:00 pm. Admission is $1.00. Tables are $5.00 if a written reservation is made before February 7, 1982, and $7.50 for any tables remaining after that date. Refreshments will be available. Talk-in on .01/.61 and .52. For reservations, contact Mac W1BK, 128 Forest Avenue, Hudson MA 01749.

MANSFIELD OH
FEB 14

The Mid-Winter Hamfest/Auction will be held on Sunday, February 14, 1962, at the Richland County Fairgrounds, Mansfield OH. Doors will open to the public at 8:00 am. Tickets are $2.00 in advance and $3.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Half tables are available. Features will include prizes, an auction, and a flea market, all in a large heated building. Talk-in on 146.34/.94. For additional information, advance tickets, and/or tables, send an SASE to Harry Frietchen K8HF, 120 Homewood Road, Mansfield OH 44906, or phone (419)-529-2801.

VERO BEACH FL
FEB 20

The Treasure Coast Hamfest will be held on February 20, 1982, at the Vero Beach Community Center, Vero Beach FL. Admission is $2.00 in advance and $2.50 at the door. Features will include prizes, drawings, a QCWA luncheon, and tailgating. Talk-in on 146.13/.73, 146.52/.52, 146.04/.64, and 222.34/223.94. For additional information, write PO Box 3088, Beach Station, Vero Beach FL 32960.

ELKIN NC
FEB 21

The fifth annual Elkin Winter Hamfest will be held on Sunday, February 21, 1982, at the Elkin National Guard Armory, located one mile from Interstate 77 at exit 85, Elkin NC. Breakfast and lunch will be served at the hamfest by the Foothills ARC of Wilkesboro NC and the Briarpatch ARC of Galax VA. Talk-in on 144.77/145.37, 146.22/146.82, and 146.52. For table reservations, ticket inquiries, or other information, contact Earl Day WB4GQP, 131 Harris Avenue, Elkin NC 28621, or phone (919)-835-3509.

GLASGOW KY
FEB 27

The annual Glasgow Swapfest will be held on Saturday, February 27, 1982, beginning at 8:00 am CST at the Glasgow Flea Market Building, 2 miles

Continued on page 133

REVIEW

THE AEA MBA-RO —A SECOND GENERATION MORSE/RTTY READER

RTTY/Morse-code readers are rapidly gaining acceptance in the amateur community, and for a good reason—a reader allows people to sample the activity on RTTY without making the substantial outlay required for a complete system. And while few will admit to it, there are an awful lot of people having an awful lot of fun copying CW with these things! Consequently, AEA's introduction of the MBA-RO reader came as no surprise. AEA has earned a reputation as a major innovator in sophisticated Morse keyers, so it seems logical that they would introduce an equally sophisticated code reader, and in fact they have.

The AEA MBA-RO is a microprocessor-controlled reader designed to display Morse, Baudot, and ASCII codes. While hardly the first such device available to the radio amateur, the MBA-RO incorporates several important improvements over the first generation of readers.

The Features

The MBA-RO is housed in an attractive metal cabinet, measuring 8-3/4" × 5-7/8" × 2". A thirty-two character vacuum fluorescent display allows the operator to see more of a sentence than readers which display only eight or ten characters at a time. This is useful under any conditions, but is particularly helpful when high levels of QRM make for rough copy. It's much easier to make sense out of garbled copy when several words are available for viewing.The bright blue digits make the display readable even under high ambient lighting conditions.

Underneath the display are three knobs. The one on the right is the mode and speed selector. Speeds of 60, 67, 75, and 100 wpm are provided for Baudot RTTY, and ASCII can be displayed at either 110 or 300 baud. Speed in the Morse-code position is tracked automatically, up to 99 wpm. There is a second Morse-code position that causes the speed to be displayed on the far right of the display.

On the left side of the display is the filter selector. While most code readers use only the mark frequency for decoding RTTY, AEA's engineers chose to include filters for both the mark and the space frequencies. This is the method used in virtually all demodulators designed for use with traditional RTTY equipment, and it provides more accurate decoding under high QRM conditions. Prototype samples of the MBA were capable of tuning only one shift, but two shifts are included on production models. Our test unit was equipped to copy 170-Hz and 425-Hz shifts, allowing copy of news services as well as HF ham activity. Those who live where there is RTTY activity on VHF may wish to retune one of the filter positions for an 850-Hz shift. This is a simple procedure requiring an accurately calibrated audio generator. If you don't feel like retuning one of the filters but wish to copy a nonstandard shift, you can place the filter in the CW position and decode only the mark frequenly. Finally, all filters can be switched out completely.

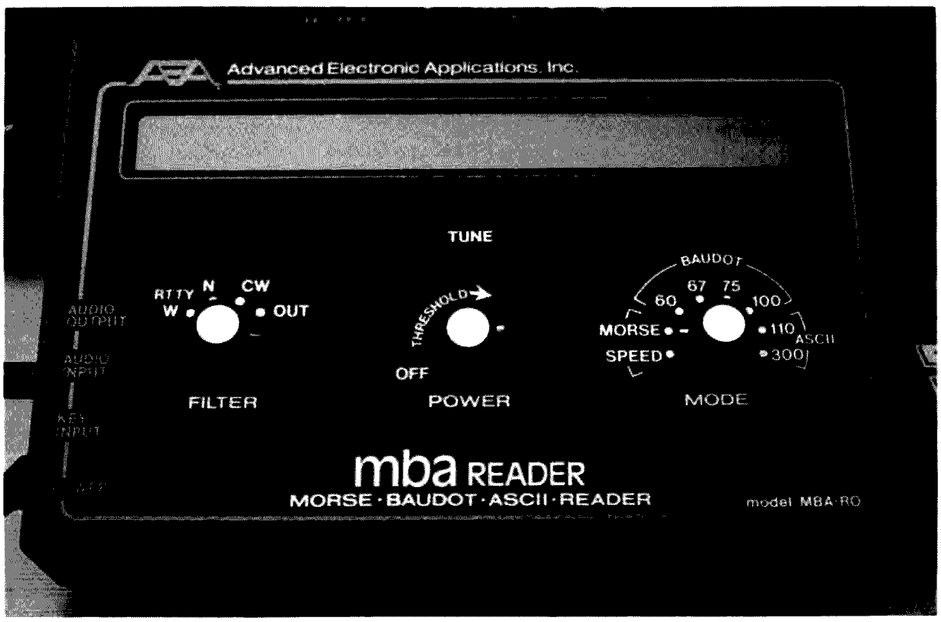
The control in the very center of the MBA is marked "Threshold," and above this are two LEDs marked "Tune." The control and LEDs are used to make fine adjustments of the MBA's filters. More on the use of these later.

On the left side of the reader is a row of jacks. There is a 13-V power input (13 V dc ± 2 V at 500 mA), audio input, audio output, and key input. The audio input can be connected to the speaker output of a receiver, and an external speaker to the output of the MBA. The key jack can be wired in parallel with a keyer, as long as it is wired for positive keying. An external RTTY demodulator can also drive the reader through this jack.

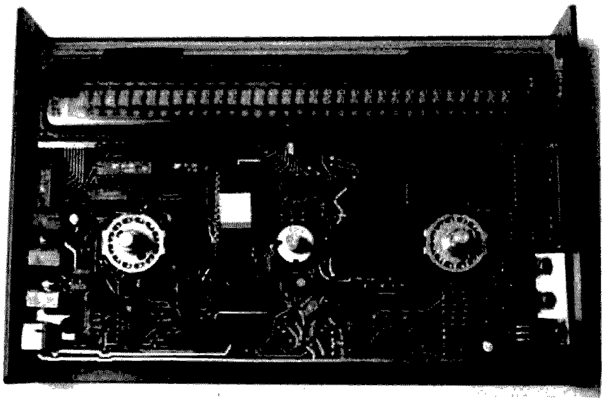
In Use

Getting the MBA-RO on line couldn't be much easier. A small bag of plugs is provided, and a few minutes spent with a soldering iron should produce all the necessary power and audio cables. Making it display off-the-air code can be a bit frustrating until you have a clear understanding of how the Threshold control works. Reading the manual should clear up any problems. I tried CW operation first, which was extremely simple using my IC-701 with its narrow audio filter switched in. The CW filter in the MBA is so sharp (100 Hz!) that I really don't need the Icom's narrow filter—I just use it to make tuning easier. The center of the filters in both the Icom and the MBA are very close to the same frequency, so peaking a signal in the center of the receiver's passband ensures good copy on the reader. I find it necessary to ride the audio gain control a little more than with other readers I have used; perhaps a tighter agc stage would help here.

The area where most readers show their limitations is in copying poorly sent CW. Most hams' fists are sloppy at best, and it is pretty hard for a small computer to decipher some of the stuff we try to pass off as Morse. The MBA produces copy as good as anything else I have used , and I've tried just about everything! I tuned across one station who was apologizing for his poor sending with a straight key—the MBA copy was perfect. Still, if an operator runs his characters together or uses highly Individualized weighting, no machine will provide good copy. The MBA follows changes in speed automatically in the Morse mode. Other systems require you to select a range of speeds or push a reset button when tuning in to another station. The speed did adjust very quickly, although it was occasionally fooled by sloppy sending. The bottom line on the MBA's CW capabilities? If someone is using a keyer and is not running his characters together, the MBA copy will be almost flawless. If someone is pretty good with a straight key, that will be decoded well, too. A surprisingly high level of QRM is



The AEA MBA-RO Morse/RTTY reader.



Inside the MBA-RO.

necessary to disrupt copy, due to the narrow internal filters.

RTTY

Performance in the RTTY mode was even more impressive than CW. The MBA copied every bit as well as most of the computer/interface combinations available. It is at a disadvantage at 300-baud ASCII because text flies by so fast you cannot read it! It is doubtful that you'll encounter much 300-baud ASCII, however.

If you have a general-coverage receiver, you may enjoy checking out the news services. AEA thoughtfully includes an order form for a book that lists the time, frequency, shift, and speed of the various services. It's definitely worth getting. If I could just interface the MBA to my MX-80 printer, I would be completely happy. Actually, an up-market MBA with a printer interface should be available by the time you read this review.

The only thing I can really complain about is the necessity of having one's receiver set in the USB position. Since most other RTTY gear is designed to operate on LSB, a switch to invert operation would be handy. This should be relatively simple to add.

Any device that contains a microprocessor emits a certain amount of noise, and the MBA is no exception. Our unit was a very early production model, and there was a just perceptible amount of hash present. AEA now has a very simple modification that reduces even this amount of noise by 40 dB or so. We didn't try the mod, but all units now available probably have the improvement already installed. Let it suffice to say that even the unimproved version is quiet enough for weak-signal work in both CW and RTTY. With the kind of antennas I've had to use lately, everything seems weak!

Conclusion

The MBA-RO performed exactly as claimed and should make an excellent shack addition for anyone interested in Morse or RTTY. The 32-character display alone gives it a significant advantage over other readers on the market. AEA will shortly be announcing a version of the MBA that incorporates a keyer and allows RTTY to be sent with a paddle—ideal for DXpeditions and maritime mobile stations! For more information, contact *AEA, Inc., PO Box 2160, Lynnwood WA 98036.* Reader Service number 477.

Paul Grupp KA1LR
***73 Magazine* Staff**

THE YAESU FT-290 —A MULTIMODE MARVEL MADE TO GO ANYWHERE

The Yaesu FT-290 is a unique product, which in itself is unusual in today's copycat world of look-alike transceivers. It is a synthesized multimode (USB, LSB, CW, and FM) two-meter transceiver designed for use under a wide variety of conditions. What makes the FT-290 unique is the level of sophistication packed into such a portable unit. Although it outwardly resembles many multimode two-meter rigs, this one has provision for an eight-nicad C-cell internal battery pack capable of supplying 2 Ah of current!

The Features

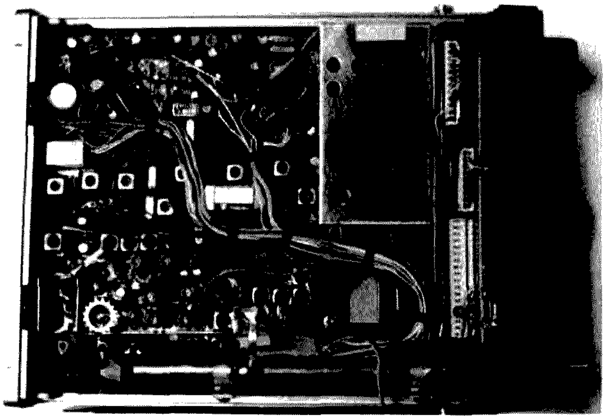
Yaesu's engineers have attempted to produce a two-meter rig that will be all things to all hams, and they appear to have succeeded. Hams with mountaintopping aspirations will appreciate the compact size and low current consumption. At 50 mA receive/800 mA transmit, those eight C-cells last forever between charges! There is an internal quarter-wave whip, but also a standard UHF connector to which you can connect a more ambitious antenna. The rig and a compact quad or yagi will be a welcome addition to many a backpacking ham's outfit.

The Yaesu FT-290 multimode 2m transceiver.

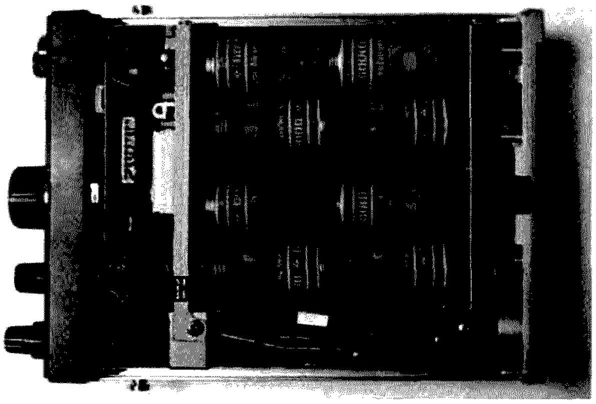
OSCAR fanatics will find plenty to be enthusiastic about as well—the FT-290 operates on both sidebands and allows the operator to change frequency while transmitting.

Operators who only do a little sideband work won't have to give up any features they've come to rely on in FM-only rigs. There are 10 memories protected with a five-year lithium battery backup, choice of stepping rates for the synthesizer, a tone burst generator, provision for an optional internal CTCSS encoder, manual band and memory scanning from the microphone, and automatic scanning for either open or busy channels. Other useful features include an LCD display, a priority channel scanning circuit, two vfo's, a clarifier, and a very attractive price tag. From an rf standpoint, the 290 keeps up with the pack—FM sensitivity is .25 uV for 12-dB SINAD, and SSB/CW is .5 uV for 20-dB S/N. Selectivity is 2.4 kHz at -6 dB and 4.1 kHz at -60 dB (SSB/CW) and 14 kHz at -6 dB and 25 kHz at -60 dB (FM).

So what's the hitch? Well, the FT-290 only puts out 2.5 Watts of rf. They had to make room for those batteries somehow! For anything but portable work, a separate amplifier is mandatory. Fortunately, Yaesu has a matching 10-Watt linear amplifier available, the FL-2010. The amplifier is directly keyed by the FT-290 with a dc voltage carried on the antenna lead. It's a reasonably compact package and works well. Ten Watts should be adequate for FM operation, but serious SSB operators may want a little more power.



Top view of the FT-290.



Bottom view of the FT-290.

In Use

The human engineering factors are excellent by any standard. In this respect, the FT-290 is Yaesu's best product yet. For example, the priority channel is not just a single channel—you can choose one of any of the ten memories. Dial up a frequency on the main vfo knob, select one of the memories, and punch the priority switch. A beep will confirm that the switch was activated, and a "P" will appear briefly on the display to let you know that you're in the priority mode. Every few seconds, the priority channel will be checked for activity. If there is activity, the 290 will lock onto that frequency and remain there. Neat! This isn't the only well-thought-out feature. Almost every control and feature appears to have received a great deal of thought. The only inconvenience I encountered was the location of the switch that selects scanning for a busy or open frequency. It's located inside the battery compartment, which means that you had best plan on not changing it too often.

Transmit audio is good in both SSB and FM. I listened on a Kenwood TR-9000 while another staff member transmitted on the 290 and heard no problems. Received audio isn't quite as good as I've come to expect; the frequency response is narrow and the audio has a slightly muffled quality. This is considerably improved with an external speaker.

Conclusions

The FT-290's versatility is a powerful argument in its favor. New Hampshire has no lack of mountains to climb, and once stuffed in its rugged case, this transceiver is a worthy companion on any outing. The only other rig available that comes close is the Icom portable SSB rig, but it lacks FM capability and the sophisticated features of the 290.

Aside from versatility, the FT-290 gets high marks in performance and human engineering. If this rig is any indication, we can expect to see great things from Yaesu in the not-too-distant future. For more information, contact *Yaesu Electronics Corp., 6851 Walthall Way, Paramount CA 90723.* Reader Service number 481.

Paul Grupp KA1LR
***73 Magazine* Staff**

THE TELTONE M-929 —UN-TOUCHY TONE DECODING

During the nearly 9 years I have been working with repeater autopatches and other touchtone™-operated systems, I have tested and compiled information on a great number of touchtone decoders.

Recently, after spending much time trying to cure the voice falsing problems associated with one type of digital decoder, I ran across an ad for the Teltone M-927 decoder in a trade magazine. They advertised it as the system that "beat Dr. Glitch." Wow, did that catch my eye! The ad had barely come to rest on the top of my desk before I had called the company and ordered one. Normally, I am very skeptical of all-on-one-chip decoders. Because of the rigorous demands of radiotelephone operation, most decoders usually require some adjustments via external circuitry to make them work properly in a radio system. All-on-one-chip systems often lack the access needed to make these adjustments. Not so with this decoder. In fact, this decoder is so flexible and works so well that I had to let my fellow touchtone sufferers know about it.

The M-927 decoder is a complete system contained in a single 40-pin dip package. The only external component needed is a 3.58-MHz color burst crystal. The bandsplitter filters and wave-shaping circuitry, major headaches in other systems, are all included on one of the two LSI chips in the M-927 package. Furthermore, since the audio inputs to the differential amplifier are designed to attach directly to the telephone lines, they are internally capacitively coupled and capable of with-

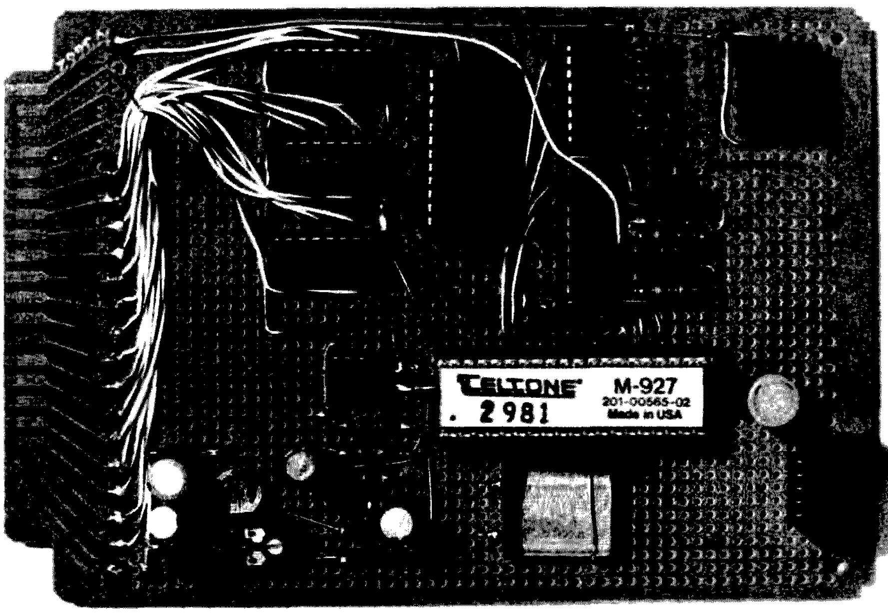


Photo A. The assembled tone decoder board. (Photo by Vic Klein WA4THR)

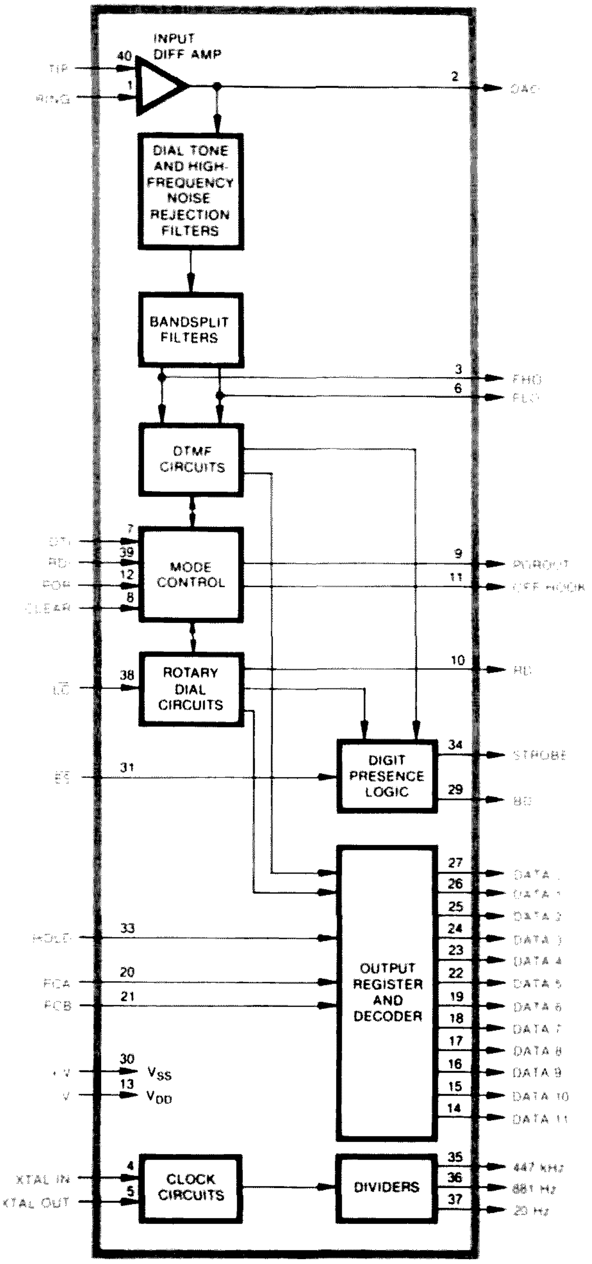


Fig. 1(a). The M-927 block diagram.

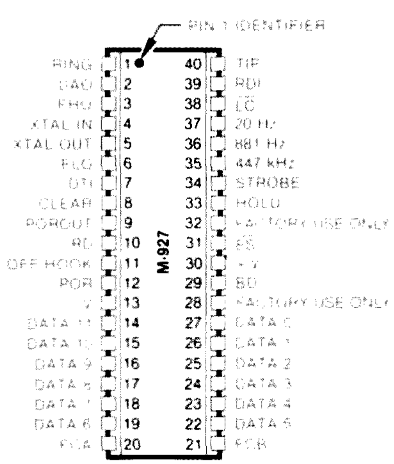


Fig. 1(b). Pinout of the M-927.

DATA	1	2	3	4	5	6	7	8	9	0	*	#	A	B	C	D
0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1

1 OF 12 OUTPUT FORMAT
FCA 0 FCB 0

DATA		1	2	3	4	5	6	7	8	9	0	*	#	A	B	C	D
BINARY	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
BINARY	1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
BINARY	2	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
BINARY	3	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
2 OF 7	4	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1
2 OF 7	5	1	1	1	0	0	0	1	1	1	1	1	1	1	0	1	1
2 OF 7	6	1	1	1	1	1	1	0	0	0	1	1	1	1	1	0	1
2 OF 7	7	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0
2 OF 7	8	0	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1
2 OF 7	9	1	0	1	1	0	1	1	0	1	0	1	1	1	1	1	1
2 OF 7	10	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1	1
	11	1	1	[illegible]	1	1	[illegible]	1	1	[illegible]	[illegible]	1	1	0	0	0	0

BINARY AND 2 OF 8 OR 2 OF 7
OUTPUT FORMATS
FCA 1 FCB 0

DATA	1	2	3	4	5	8	7	8	9	0	*	#	A	B	C	D
0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
2	0	0	0	1	1	1	1	0	0	0	0	,	1	1	1	0
3	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

BINARY OUTPUT FORMAT
FCA 0 FCB 1

DATA	1	2	3	4	5	6	7	8	9	0	*	#	A	B	C	D
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

BLANK OUTPUT FORMAT
FCA 1 FCB 1

Table 1. Output formats.

standing differential voltages up to 1500 volts. For single input operation, no biasing components are needed. Figs. 1(a) and 1(b) show the decoder block diagram and pinout.

In addition to the touchtone decoding portion of the circuit, Teletone makes provision for dial pulse input as well.The circuit is capable of accepting either touchtones, dial pulses, or both. A couple of enable lines (DT1, RD1) enable the user to selectively inhibit either type of operation.

Data is output from the decoder in one of four selectable formats shown in Table 1. Format 3 is interesting in that when it is selected both binary and 2-of-8 codes are available simultaneously. The blank output format can be used to clear the output latches in applications where momentary output coincident with signal presence is required. In addition to numerical outputs and several testpoints, clock outputs of three different frequencies are available along with a strobe line and a power-on-reset line.

Putting the Decoder to Work

Two weeks after placing the order, I received the decoder. I immediately put it in the circuit shown in Photo A and schematically depicted in Fig. 2. The components before and after the decoder are not absolutely necessary, but I have learned that when lightning strikes it is nice to have buffers between expensive parts and the outside world! The display is convenient for reading the decoder output.

The 741 op amp routes audio from either the main or auxiliary receivers to the decoder audio input in addition to acting as a lightning buffer.

The CD4515 decodes the M-927's binary output into 16 separate outputs which are then inverted and buffered by the CD4049 ICs. The strobe pulse from the M-927 is inverted and delayed by an RC network and a 74C14 Schmitt trigger inverter before being fed to the enable line of the CD4515 decoder. An additional RC network and inverter further delay the strobe pulse before it is output from the tone-decoder board. These delays ensure that *both the rising and falling edges* of the strobe pulse occur while the data is available at the outputs of the CD4049 inverter/buffers.

Since the M-927's strobe line is connected to the enable line of the CD4515, data is only output from the board while the tone is actually present.

Lastly, the CD4511 display decoder transforms the M-927's binary output to seven-segment form and directly drives a seven-segment common cathode display providing a visual indication of tone-decoder operation.

A lot of decoding on one board, isn't it?

One unrelated aspect of the schematic I'd like to point out is the 15-volt, 1-Watt zener across the power supply inputs. This lit-

tie device has saved many expensive ICs in the past by shorting out and burning the power trace right off the board when a voltage regulator went awry or when a lightning bolt hit. It is well worth its insignificant cost.

The Acid Test

Despite the impressive specifications of many touchtone decoders, they often bite the dust when faced with the acid test—amateur repeater operation.

Not this decoder! The M-927 took charge. It stubbornly refused to false decode despite the efforts of our best touchtone imitators. It ignored all manner of squawks and squeals. When it came to touchtones, though, the M-927 really came through. I couldn't hit the buttons on my TT pad fast enough to escape decoding. Even the fastest automatic dialers weren't fast enough to go undecoded!

During the several months that the M-927 has been installed in our system, it *has* voice falsed, but only twice. Not bad considering the many hours of voice, squelch noise, squawks, and squeals to which it has had to listen!

Rather than leave you with the thought that the M-927 is the perfect touchtone decoder, which it very nearly is, I must point out a few of its shortcomings as well.

The first and worst deficiency noted during several months of repeater operation was the M-927's relatively high signal-to-noise ratio requirement of 25 dB. In repeater terms, this means that the M-927 will not pick a weak signal out of the noise. In practice, we found that if a signal was too noisy for autopatch, it was also too noisy to bring it up. This turned out not to be such a bad shortcoming after all! If you need weak signal capability, Teltone was thinking of you when they created the M-927's big brother, the M-937. It is shown in Photo B. The M-937 has the same features as the M-927 with a signal-to-noise ratio requirement of only 10-15 dB. Although I haven't tested it, Teltone claims that the M-937 *will* pick signals out of the noise. A side-by-side comparision of specifications of the M-927 and M-937 is shown in Table 2.

A second deficiency, shared by all types of decoders, is temperature range. The M-927 will operate over the range of 0° C to 70° C. The M-927 can stand the heat of summer, but on cold winter days you'll need to keep it above the freezing mark.

Every weekend our repeater is remotely (via touchtone) switched to standby battery power. During one such weekend I discovered the M-927's third minor flaw—limited voltage range. Although all of our repeater control circuits are CMOS and are capable of operating down to 3 or 4 volts, the M-927 quits working when its supply voltage goes below about 11 volts. According to the data sheet, the M-927's operating voltage range is 11 to 13.5 volts. Believe it! I nearly had to take the long hike up the mountain to reset the repeater, but luckily after a short period of inactivity the battery recovered to a voltage sufficient to let the M-927 accept my reset command. For battery operation, therefore, I would recommend some type of 12-volt backup supply just for the decode itself.

No other shortcomings were found during three months of

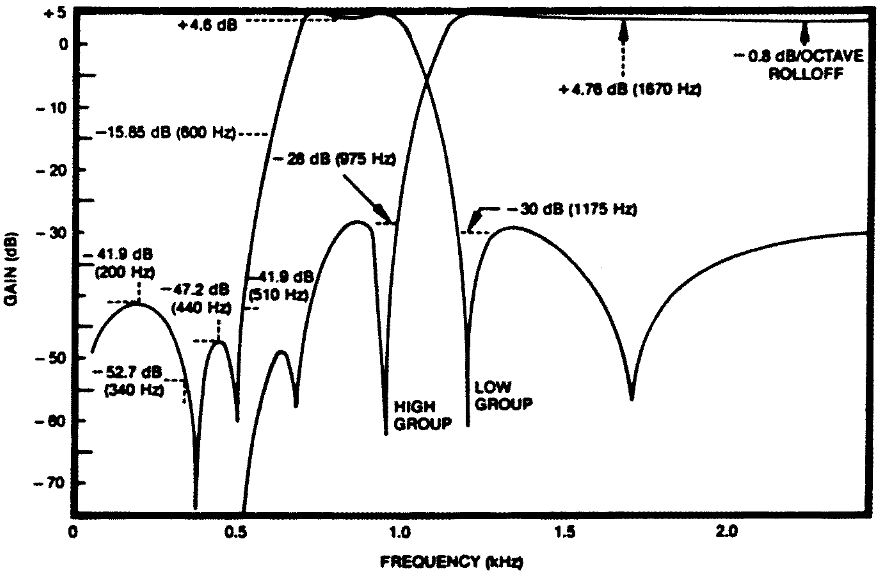


Fig. 2. Bandpass filter characteristics of the M-927.

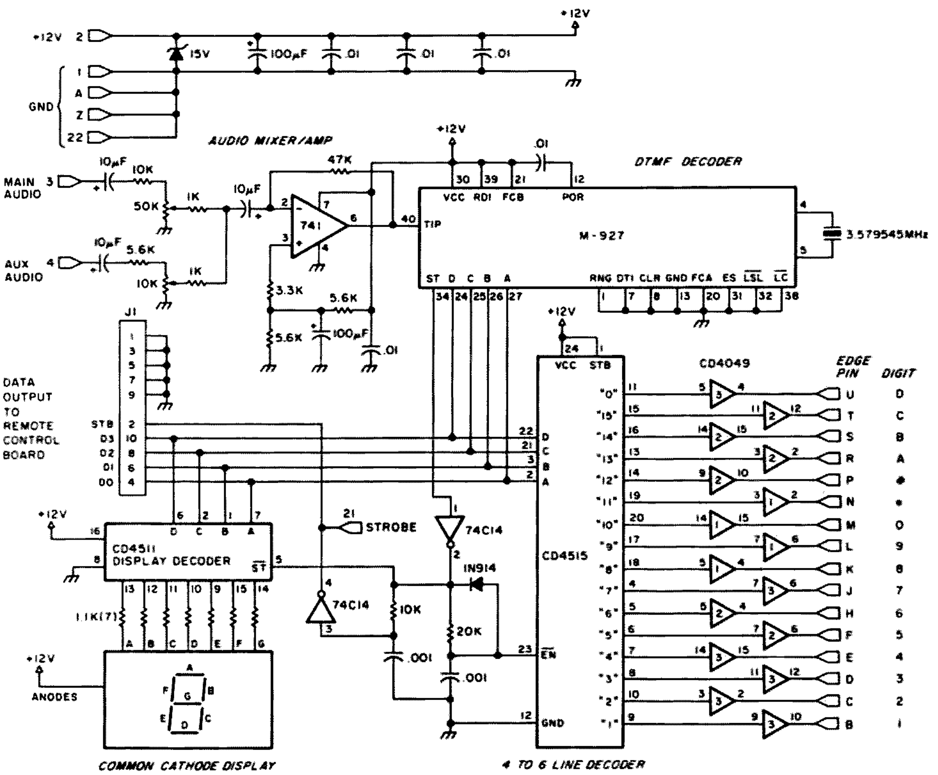


Fig. 3. The tone decoder board schematic.

Specification	M-927	M-937	Comments
Input Impedance f≤1 MHz	500k minimum single ended 1 M minimum	300k minimum single ended 600k minimum	The Mitel chip set cannot be connected differentially without external parts.
Common mode noise tolerance	60 Vrms minimum f≤100 Hz	60 Vrms minimum f≤120 Hz	
Input sensitivity ("A" Level)	−30 dBm	−20 to −46 dBm (adjustable)	Measured as high as −28 dBm with a 5-V supply
Maximum input level	+6 dBm minimum	A+45 dBm minimum (+10 dBm maximum)	
Signal level reject	−40 dBm	A-8 dBm	
Signal bandwidth accept	±(1.5% + 2 Hz) minimum	±(1.5% + 2 Hz) minimum	Chip set will not detect 100% at band edges and 40 ms ON and OFF, only about 95%.
Signal bandwidth reject	±3.5% maximum	±3.5% maximum	
Twist tolerance (fH/fL)	±8 dB minimum	±10 dB minimum nominal frequency	Must be at nominal frequencies.
Signal recognition time	25 ms minimum 40 ms maximum	25 ms minimum 40 ms maximum	Nominal frequencies
Pause recognition time	20 ms minimum 40 ms maximum	20 ms minimum 40 ms maximum	
Signal-to-noise ratio (300-3400 Hz band limited)	25 dB maximum	15 dB maximum	45 ms ON, 45 ms OFF.
Speech immunity Mitel CM7291	3 hits typical	1 hit typical	

Table 2. Specification comparisons of the M-927 and the M-937.

operation in our repeater system. I am well pleased with the M-927's operation in our repeater and hope that this untouchy tone decoder will alleviate your touchtone headaches as well.

The M-927 is currently available directly from Teltone for $75 in single quantities, while the M-937 is priced at $131.

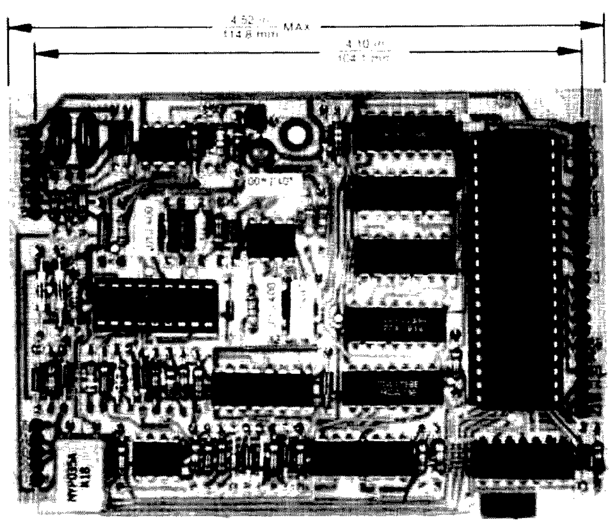


Photo B. The M-937 touchtone decoder.

At this writing, Teltone is preparing to announce the M-947, which is a stripped down M-927. The M-947 will have the front-end filters and tone-decoding circuits, but will not have the dial pulse circuits. It will have binary outputs only and come in a 22-pin package. Projected price will be in the $25-$30 range in single quantities.

For more information or a copy of my reference, the M-927 DTMF Receiver Data Sheet (Copyright 1980), contact *Teltone Corporation, PO Box 657, 10801-120th Avenue, Kirkland WA 98033; phone (206)-827-9626.* Reader Service number 476.

Robin Rumbolt WA4TEM
1134 Glade Hill Road
Knoxville TN 37919

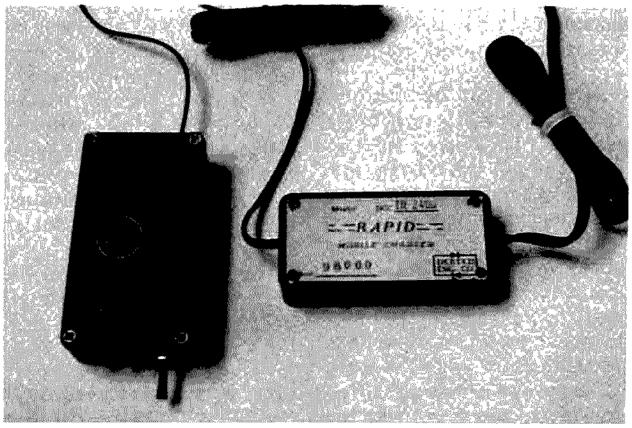
CHARGE IT! —REPORT ON MODELS FROM DEBCO AND INDIANA QUICK CHARGE

Find something that people want and fill the demand. That is how fortunes are made. The demand for a better way to charge nicad batteries came about shortly after synthesized handie-talkies arrived on the amateur market. Frustrated by the slow charging rate of the simple plug-in adaptors and horrified by the lack of availability and high prices for the official accessory chargers, hams learned to roll their own and before long several enterprising fellows started selling them. I don't know if they have made a fortune yet, but firms like Debco Electronics and Indiana Quick Charge are out to meet the demand.

Testing chargers can be a bit frightening since you are trusting your expensive radio to a power supply designed by someone other than the manufacturer. Most of the synthesized rigs are designed to operate in a tight voltage range. Kenwood's TR-2400, for instance, can be damaged if the input level exceeds 10 volts. Both of the chargers reviewed contained some sort of voltage regulation, but the similarities end there.

Debco's model, the Deb-Ted Rapid Mobile Charger, is designed to act as a go-between between the car cigarette lighter and the rig's battery charger socket. A small plastic box holds a circuit board that features a 723 regulator chip plus one other IC and four transistors. The result is a constant voltage charger that will bring your batteries up to full capacity in about five hours. As the batteries reach capacity, the current level falls off, preventing the harm that may result from overcharging.

Like the Debco unit, Indiana Quick Charge's QC-500 features talk-while-you-charge operation. The QC-500 circuitry is centered around a garden variety LM340 voltage regulator. The design includes two fuses and a hefty filter capacitor. Unlike the Deb-Ted, which is a plug-it-in-and-forget-it device, the Indiana Quick Charge unit gives the operator a switch to select between on and off, and there are three LEDs that indicate the presence of input voltage, a



The Debco Deb-Ted Rapid Mobile Charger and the Indiana Quick Charge QC-500 charger.

short circuit on the output, and the normal output condition. A die-cast aluminum case compliments the QC-500's clean, professional layout.

The QC-500 has proven to be a flexible accessory; it can be powered by either a 12-volt lighter or via a wall adaptor transformer. Debco has chosen to offer separate models, one for 12-volt use, the other for 110 V ac. Each company's charger will bring a discharged battery back to life in far less time than the conventional overnight chargers. However, many of the HTs in use today contain batteries that were not specifically intended for these faster energy transfer rates. Luckily, nicads tend to be forgiving and there were no obvious side effects resulting from the use of "quick" or "rapid" chargers.

One problem that plagues an owner of either charger is nonconventional wiring of an automobile's cigarette lighter socket. If you own a late model car and your charger doesn't seem to work, check the polarity of the socket. Normally, the tip is positive and the outer contact goes to ground. Both the Debco and Indiana Quick Charge units have diode protection in case the voltage is reversed. Correcting the problem involves reversing the leads at the socket or inside the charger case since the plugs cannot be disassembled.

Although our tests used a TR-2400, Debco and Indiana Quick Charge chargers are available for most of the other popular synthesized rigs. You can adjust the internal potentiometer if you need a different voltage rating. Don't fall into the trap of trying to use a line straight from 12 volts to your radio. You'll probably end up with a fried radio and an expensive repair bill.

Both chargers have a lot to offer. I liked the QC-500's classy appearance and flexibility, but I was also impressed by the Deb-Ted's sophisticated circuitry. Perhaps the two firms could get together and produce a super charger.

For more information, contact the manufacturers: *Debco Electronics, PO Box 9169 Dept. C, Cincinnati OH 45209,* Reader Service number 479; *Indiana Quick Charge, 367 West Main St., Danville IN 46122,* Reader Service number 480.

Tim Daniel N8RK
***73 Magazine* Staff**

THE MICROWAVE MODULES MORSE TALKER —AN INFINITELY PATIENT TEACHER

Ah, the great stumbling block: learning the Morse code. Everyone looks for the easy way out, and manufacturers have been quick to provide all sorts of tapes, records, books, and flash cards to help out the would-be ham. With all these devices aimed at teaching the language of dah-di-dah, it takes quite an unusual approach to merit a second glance.

The Morse Talker, manufactured by Microwave Modules and imported by Spectrum International, is unusual enough to be worth not only a second, but even a third glance from both teachers and learners of the code.

The Talker is a small black box with an imposing number of switches and LEDs on its front panel. It generates Morse characters in random order. That's not so unusual, you say. Lots of modern keyers will send random Morse. Ah, but how many of them actually *talk* to you?

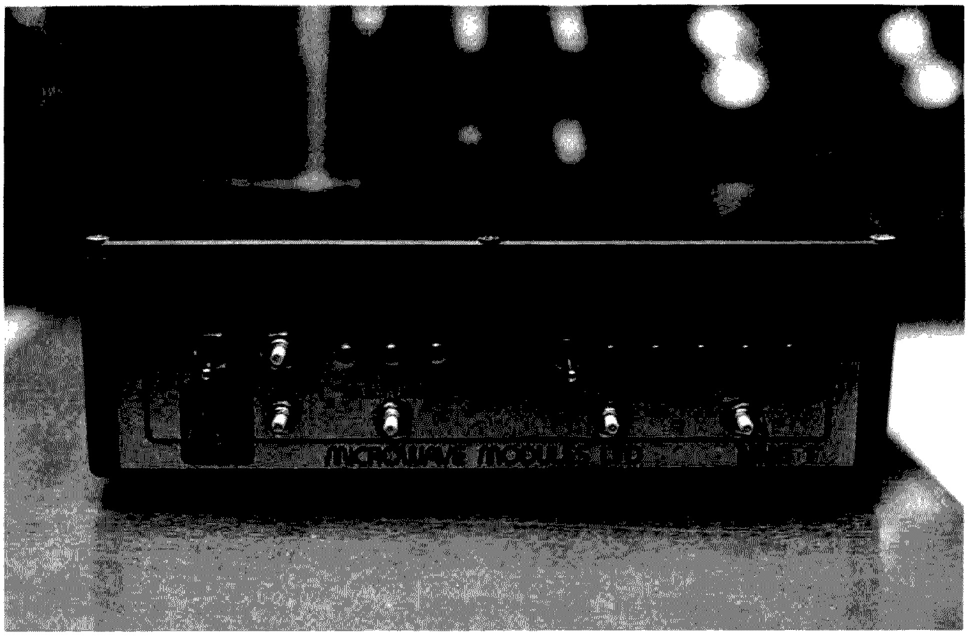
The secret of the Morse Talker is a voice synthesizer that tells you, after one, five, or fifty characters have been sent, what those characters were. It's quite impressive to hear this small device send fifty letters and numbers and then, in a voice right out of Star Wars, read them back to you.

You get instant feedback and, more importantly, in the single-letter mode the Morse Talker helps you associate a Morse rhythm with the letter it represents without the need of any visual crutch that will have to be discarded later. The learning process depends totally upon sound, and in theory this should make learning the code an easier task and make speed increases less painful.

Speeds from 2 to 20 words per minute can be selected. At the lower speeds, the code is sent at 12 wpm and spaced out enough to achieve the desired speed. An optional IC can be plugged in to set a speed range of 12 to 48 wpm. The Morse Talker can be programmed to send the entire alphabet and figures, or segments of the alphabet, with each segment adding new letters to the previous one.

The Morse Talker is enclosed in a die-cast box and all components are mounted on two double-sided glass-epoxy circuit boards, one of which contains a microprocessor that generates the code and tells the synthesizer what to say. The code generator program is contained in a 2716 EPROM. The second board contains a Digitalker voice synthesizer with its own microprocessor and memory.

The unit contains a small built-in speaker which provides adequate volume for a small room, or an external speaker or



The Microwave Modules Morse Talker.

amplifier can be plugged into a jack on the rear panel. There is also provision for operation as a code practice oscillator by connecting a straight key. A 12-V power supply is required for operation. One failure of the design is the lack of a power on/off switch or accessible volume control (the volume is only adjustable internally).

The only real disadvantage of the Morse Talker is its expense—not too many prospective Novices are going to be able to rush out and buy one, although the price should be in reach of most clubs sponsoring license courses. Aside from its price, the Morse Talker offers several advantages that make it a very useful training aid.

First, the biggest problem with tapes and records—memorization—is eliminated by the random generation of characters. Second, many users will find using the individual letter mode a very effective way to learn the code. Third, a "test" of 5 or 50 characters sent before reading back the answers provides a useful measuring stick.

We haven't had the opportunity to give the Morse Talker a real, total-beginner-to-licensed-ham test, but one student who had a chance to use it along with her other code-learning aids (including one each of just about every tape and record made) found it to be the single most useful part of her repertoire. She set up the machine to send individual letters at about 12 wpm and concentrated on connecting the sound with the letter. A half hour a day with the Morse Talker resulted in learning the characters quite rapidly.

In the end, though, whether you use the Morse Talker or a key and buzzer is not as important as whether or not you are willing to spend some time and effort on learning the code.

For further information, contact *Spectrum International, Inc., Box 1084S, Concord MA 01742*. Reader Service number 478.

John Ackermann AG9V/1
***73 Magazine* Staff**

FCC

USE OF ADDITIONAL DIGITAL CODES BY AMATEURS PROPOSED (Docket No. 20777 and PR Docket No. 81-699)

In response to a rulemaking petition by the American Radio Relay League (ARRL), the Commission is proposing to amend Part 97 of its rules to permit the use of new and experimental digital processes by amateur radio operators.

Currently, the only digital codes authorized for amateur use are ASCII (American Standard Code for Information Interchange) and the Baudot code. Such limitations may be discouraging the kind of innovation in the Amateur Radio Service the Commission has explicitly sought to encourage. For example, in 1976 the FCC began a rulemaking in Docket 20777 to deregulate amateur radio by eliminating emission-type restrictions. Because of comments filed in that proceeding, the Commission decided not to relax emission requirements but did authorize amateurs to use the ASCII code.

Because Docket 20777 is dated, the Commission is terminating that proceeding and associating the ARRL's request with a new digital coding proceeding.

The FCC proposes authorizing the use of any digital code in the transmission of amateur radio communications on frequencies above 50 MHz for domestic communications only. The frequency limitation is intended to protect operations in other countries from possible interference from the transmission of nonstandard codes.

Stations would still be required to identify themselves using conventional voice or telegraphy and would be required to maintain a record of the codes used and provide that record to the Commission on request. At any time, the Commission could restrict or prohibit the use of codes other than ASCII or Baudot by certain stations. These provisions are intended for monitoring and enforcement purposes.

The Commission further proposes to authorize an additional emission mode for ASCII in certain bands, increase ASCII sending speeds in certain bands, and clarify requirements by replacing the term "baud" with "bits per second."

In a related matter, the Commission denied a rulemaking petition requesting amendment of Part 97 by replacing the table of authorized emission types with a table of authorized bandwidths. This petition is being dismissed because it is inconsistent with the Commission's findings in Docket 20777.

Action by the Commission October 1, 1981, by Fourth Report and Order and Notice of Proposed Rulemaking (FCC 81-458 and 81-459). Commissioners Fowler (Chairman), Quello, Washburn, Fogarty, Jones, Dawson, and Rivera.

For more information contact Steve Lett at (202)-632-7597.

HAM HELP

I would appreciate hearing from anyone who has made any type of modifications to a HAL DS-2000/ST-5000 RTTY system. Mods of special interest are additions of computer-type line printers such as an Epson MX80-FT or the like. I am currently using an old Kleinschmidt 60-wpm machine, but that is no good for the other baud rates and ASCII. I do have a TRS-80 Model III, but would rather use the dedicated HAL system for RTTY. Anybody have any ideas?

Stan Gantz WB5TGL
PO Box 2820
Silver City NM 88062

Help! I need service manuals for the following obsolete FM equipment:

- G.E. "Pre-Prog" mobile, Model 4ES12A3;
- Ac "Spark Plug," Model CVT-1 (WE-15996), a.k.a. Delco Acheiverfone;
- Utica Communications Model "Uticom";
- G.E. "Prog-Line" base station, no model number, housed in a cabinet about the size of a 2-drawer filing cabinet, 25-30 MHz, Tx P.S. numbers 4EP4A1, 4EP4A2; Tx #4ET23A1; Rx P.S. #4EP3A1; RX #4ER24A1.

I also need (dead or alive) a Motorola # NPN 6013A ac supply, or a # NPN 6011 6-/12-V/ nicad supply. These were used with the old hybrid P-31/33 series of handle-talkies.

Barry Fuerst
218 Flournoy St.
Oak Park IL 60304

I am the owner of a Yaesu FT-207-R 2-meter HT. The frequency coverage is from 144 to 148 MHz. I would like to extend this range to cover MARS. I have seen articles on the IC-2A which changed its coverage from 144-148 to 140-149.9955.

This is the type of modification I would like to make to my 207-R. Any information on this mod would be greatly appreciated.

Willard Brown WB3GNN
350 Orchard St.
Old Forge PA 18518

I am looking for other ham radio operators who are owners of Atari computers for the purpose of starting a National Atari Net. This net would meet once a week on a given frequency and would enable us to exchange information and ideas concerning Atari computers.

Sheldon Leemon N8SL
14400 Elm Street
Oak Park MI 48237

I need service information on a WWII piece of equipment made under contract for the US Government. It is an RBM-5, type CAY 46077-A high-frequency receiver made by Westinghouse on contract NX57-38081 in 1942/43. I wrote Westinghouse, but they can't help.

F. Krantz
100 Osage Avenue
Somerdale NJ 08083

OSCAR ORBITS

Despite a troubled infancy, amateur radio's newest satellite, UoSAT-OSCAR 9, was alive and well as this issue of *73* went to the printer.

After a perfect launch on October 5, the first signal heard coming from the satellite was a strong carrier with only a small amount of garbled modulation instead of the expected 1200-baud ASCII telemetry. It was five days before the spacecraft was successfully directed into a 300-baud mode, giving the world a chance to obtain and digest information about the satellite's well-being.

Early data indicated that a problem existed with two of the three navigation magnetometers. Experts associated this with the colder than expected spacecraft temperature. Before any experiments can be conducted, the satellite must be stabilized, an operation that is dependent on knowing the bird's attitude and spin. Without the proper "nav mag" data, a new operational plan must be formulated. It was expected to take four to six weeks to gain full control of the situation.

Satellite enthusiasts report that OSCAR 9's 145.825-MHz beacon can be heard with a rubber-duck-equipped handie-talkie. By using a 5/8-wave or better antenna, it is possible to get a full quieting signal with an ordinary two-meter receiver. The orbital data that was available for OSCAR 9 in early October is:

- Period: 95 minutes, 28.796 seconds
- Perigee height: 533 km (331.21 mi.)
- Longitude increment: 23.86563 degrees west
- Apogee height: 536 km (333.07 mi.)

The orbital listing given below is based on this data. Since OSCAR 9 has a very short track record, the accuracy of the listing may not be as great as it would be with an established satellite.

This article is based on material from the *AMSAT SATELLITE REPORT*. For more information on the amateur space program, contact: AMSAT, PO Box 27, Washington DC 20044.

OSCAR 8 ORBITAL INFORMATION FOR JANUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
19495	1	0008:15	68.8
19509	2	0012:49	69.9
19523	3	0017:22	71.1
19537	4	0021:55	72.3
19551	5	0026:28	73.4
19565	6	0031:01	74.6
19579	7	0035:34	75.8
19593	8	0040:07	76.9
19607	9	0044:40	78.1
19621	10	0049:13	79.3
19635	11	0053:46	80.4
19649	12	0058:19	81.6
19663	13	0102:52	82.8
19677	14	0107:25	83.9
19691	15	0111:58	85.1
19705	16	0116:30	86.2
19719	17	0121:03	87.4
19733	18	0125:36	88.6
19747	19	0130:00	89.7
19761	20	0134:41	90.9
19775	21	0139:14	92.1
19788	22	0000:35	67.4
19802	23	0005:00	68.6
19816	24	0009:40	69.8
19830	25	0014:13	70.9
19844	26	0018:45	72.1
19858	27	0023:18	73.2
19872	28	0027:50	74.4
19886	29	0032:22	75.6
19900	30	0036:54	76.7
19914	31	0041:27	77.9

OSCAR 9 ORBITAL INFORMATION FOR JANUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
1307	1	0049:05	146.4
1322	2	0039:41	144.0
1337	3	0030:16	141.7
1352	4	0020:51	139.4
1367	5	0011:27	137.0
1382	6	0002:02	134.7
1398	7	0128:00	156.2
1413	8	0118:35	153.8
1428	9	0109:11	151.5
1443	10	0059:46	149.2
1458	11	0050:22	146.8
1473	12	0040:57	144.5
1488	13	0031:32	142.1
1503	14	0022:08	139.8
1518	15	0012:43	137.5
1533	16	0003:19	135.1
1549	17	0129:16	156.6
1564	18	0119:52	154.3
1579	19	0110:27	152.0
1594	20	0101:03	149.6
1609	21	0051:38	147.3
1624	22	0042:13	144.9
1639	23	0032:49	142.6
1654	24	0023:24	140.3
1669	25	0014:00	137.9
1684	26	0004:35	135.6
1700	27	0130:33	157.1
1715	28	0121:08	154.7
1730	29	0111:44	152.4
1745	30	0102:19	150.1
1760	31	0052:55	147.7

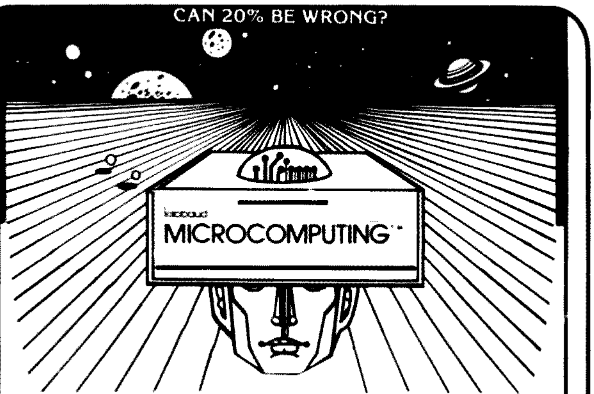
OSCAR 8 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
19928	1	0045:59	79.1
19942	2	0050:31	80.2
19956	3	0055:03	81.4
19970	4	0059:35	82.5
19984	5	0104:07	83.7
19998	6	0108:39	84.9
20012	7	0113:11	86.0
20026	8	0117:43	87.2
20040	9	0122:15	88.4
20054	10	0126:47	89.5
20068	11	0131:19	90.7
20082	12	0135:51	91.8
20096	13	0140:22	93.0
20109	14	0001:43	68.4
20123	15	0006:15	69.5
20137	16	0010:47	70.7
20151	17	0015:18	71.8
20165	18	0019:50	73.0
20179	19	0024:22	74.2
20193	20	0028:53	75.3
20207	21	0033:25	76.5
20221	22	0037:56	77.6
20235	23	0042:28	78.8
20249	24	0046:59	80.0
20263	25	0051:30	81.1
20277	26	0056:02	82.3
20291	27	0100:33	83.4
20305	28	0105:04	84.6

OSCAR 9 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
1775	1	0043:30	145.4
1790	2	0034:05	143.0
1805	3	0024:41	140.7
1820	4	0015:16	138.4
1835	5	0005:52	136.0
1851	6	0131:49	157.5
1866	7	0122:25	155.2
1881	8	0113:00	152.8
1896	9	0103:36	150.5
1911	10	0054:11	148.2
1926	11	0044:46	145.8
1941	12	0035:22	143.5
1956	13	0025:57	141.1
1971	14	0016:33	138.8
1986	15	0007:08	136.5
2002	16	0133:06	158.0
2017	17	0123:41	155.6
2032	18	0114:17	153.3
2047	19	0104:52	150.9
2062	20	0055:28	148.6
2077	21	0046:03	146.3
2092	22	0036:38	143.9
2107	23	0027:14	141.6
2122	24	0017:49	139.2
2137	25	0008:25	136.9
2153	26	0134:22	158.4
2168	27	0124:58	156.1
2183	28	0115:33	153.7

CAN 20% BE WRONG?



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SOCIAL EVENTS

from page 118

south of Glasgow on Highway 31E. Admission is $2.00 per person with no extra charge for exhibitors. One free table will be provided per exhibitor with extra tables available at $3.00 each. There will be a large heated building with plenty of free parking. No meetings or forums will be held—just door prizes, free coffee, and a large flea market. Talk-in on 146.34/.94 or 147.63/.03. For additional information, contact Bernie Schwitzgebel WA4JZO, 121 Adairland Ct., Glasgow KY 42141.

LIVONIA MI
FEB 28

The Livonia Amateur Radio Club will hold its 12th annual LARC Swap 'n Shop on Sunday, February 28, 1982, from 8:00 am to 4:00 pm at Churchill High School, Livonia MI. There will be plenty of tables, door prizes, refreshments, and free parking. Talk-in on 146.52. Reserved table space of 12-foot minimum is available. For further information, send an SASE (4 × 9) to Neil Coffin WA8GWL, c/o Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.

MIDLAND TX
MAR 13-14

The Midland Amateur Radio Club will hold its annual swapfest on Saturday, March 13, 1982, from 8:00 am until 6:00 pm, and on Sunday, March 14, from 8:00 am until 3:00 pm, at the Midland County Exhibit Building east of Midland TX on the north side of Highway 80. Registration is $5.00 in advance or $6.00 at the door. An additional $3.00 will be charged for each table. There will be door prizes. Talk-in on 146.16/146.76 and 146.01/146.61. For more information, write the Midland Amateur Radio Club, Box 4401, Midland TX 79704.

WINCHESTER IN
MAR 14

The Randolph Amateur Radio Association will hold its 3rd annual hamfest on Sunday, March 14, 1982, from 8:00 am to 5:00 pm at the National Guard Armory, Winchester IN. Tickets are $2.00 in advance and $3.00 at the door. Table space is $2.50 and table space with table is $5.00. Setup times are 6:00 pm to 8:00 pm on Saturday and 6:00 am to 8:00 am on Sunday. For reservations or additional information, contact RARA, PO Box 203, Winchester IN, or phone W9VJX at (317)-584-9361.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time away from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print (neatly!), double spaced, your request on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

Wanted: work in the electronics field in the Knoxville/Chattanooga area. Experience in digital and rf circuits. I have First Class radiotelephone and Extra class amateur licenses.

Herman F. Schnur
115 Intercept Ave.
North Charleston SC 29405

I need an instruction manual and/or schematic for a model CF capacitor analyzer (Exam-Eter) made by Solar Mfg. Corp., New York. Please write and let me know what you have.

G.V. Mock W4RHD
Rt. 1, Box 60
Fayetteville AR 72701

Wanted: any information on conversion of Cobra 21XLR to 10-meter FM. Uses Uniden PC-199AB board with crystals for 10.24, 10.695, and 36.57 MHz. Has anyone converted this rig? Help!

Al Graff N8CNB
PO Box 332
South Webster OH 45682

I need a schematic and/or manual for an Advance Instruments oscilloscope model OS 15A (sometimes called Xetex). I will copy and return. All your costs gladly paid.

Walter S. Jackson KB3LH
281 Irish Road
Berwyn PA 19312

I have the schematic for my WWII-vintage Hammarlund type CHC 46140 receiver, but no values of components are given. Can anyone supply further data on this radio?

H. Church
309 W. St. Louis St.
Lebanon IL 62254

I need a schematic or a manual on a Central Electronics multi-phase exciter, Model 10B, and Model 458 vfo. I will copy and pay all postage.

Louis Sila WB6FRQ
1085 W. 27th St.
San Bernardino CA 92405

Recently, someone wanted info on war surplus from the '40-'45 era. I had this info and was glad to supply it. My request was to have the postage paid.

I neither got the postage *nor a* thank-you. You could remind the people requesting such info that a thank-you is appreciated. It will be a cold, frosty day before I comply with another request. Since the last time, I have seen quite a few inserts I could help, but once stung, twice shy.

Leon D. Tallman W1JTI/OY1KH
Star Route
South Effingham NH 03882

Am looking for a schematic or assembly manual for a model W5M amplifier. Also same for a model WAP2 preamplifier. These are both Heathkit units. Will copy and return, postage paid. Thank you.

F.N. Lockwood WA6UCP
910 Jack London Drive
Santa Rosa CA 95405

I urgently need a schematic or any service information on the Beltek model W5570 2-meter FM transceiver. The manufacturer in California is out of business. Thank you.

Rev. Ray Vath WB2FYB
PO Box 306
Ridgefield Park NJ 07660

I have a telephone-type (PBX) headset which I would like to hook up to my Kenwood TR-2400. Any info would be appreciated.

Roy Eichelberger KA7GXX
1136 Turquoise Way
Sandy UT 84070

I would like to obtain a manual or schematic for a Gonset Sixty-Three. Also, if anyone needs a Knight Star Roamer manual for his set, he can contact me.

Kevin Neal
Rte. A, Box 221A
Flippin AR 72634

I need a manual and schematic for a General Electric oscilloscope model CRO 5A. Will copy or pay for copy. Also need parts or a used Heathkit IT-11 or IT-28 Capacitor Checker. Thank you.

William P. Pence
800 Old Stage Road
Cave Junction OR 97523

Does anybody know the type of balun and the resistance and wattage of the resistor used in B&W's new folded dipole antenna? Any information concerning the above would be greatly appreciated.

Marvin Rosen N3BQA
20 W. Madison St
Baltimore MD 21201
(301)-685-8308

Needed for parts: a beyond-repair IO-10 Heath scope to complete a partial scope kit.

Rudy Zerdecki WB1CXC
PO Box 321
Indian Orchard MA 01151

I would like a manual and/or schematic for a Tektronic Type 504 oscilloscope. I will pay copying costs.

Dr. H. Castiglione
RD #3, Box 392
Robbinsville NJ 08691

DX

Yuri Blanarovich VE3BMV
Box 292
Don Mills
Ontario M3C 2S2
Canada

One thing that is very obvious and is becoming worse with more activity on the bands is the quality of SSB signals. SSB by its nature is so pure, clean, and lean. Theoretically, two or three stations can operate almost on the same frequency. There is no carrier to interfere as we had on AM. But . . . then came those #$%& speech compressors in the hands of operators who refuse to try to understand the technical side of things. I think it must be a carry-over from the "ten-four" band where the only thing you had to know was to keep that meter way up there, because that was when you were getting more "pounds" out. Wrong!!!

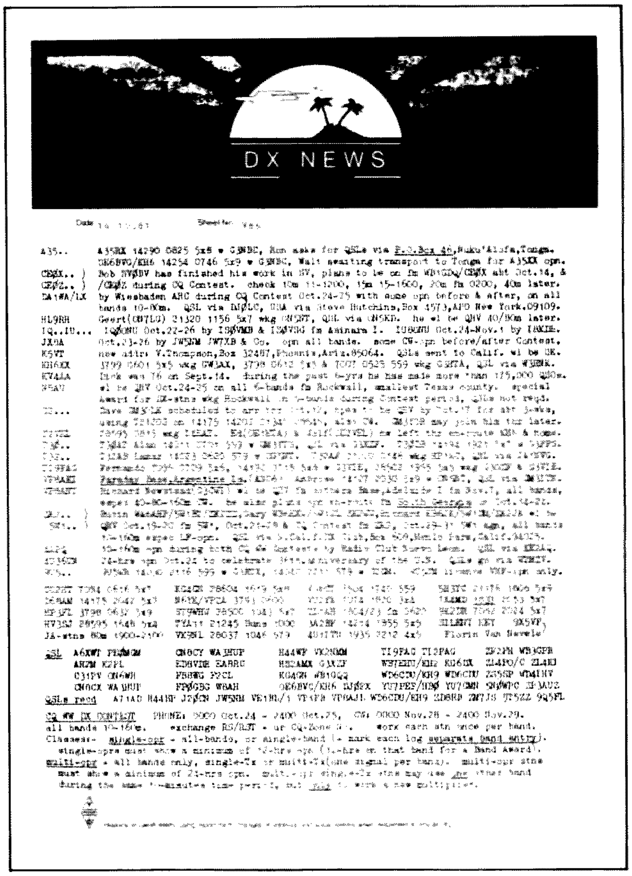
Speech processing has its value but it has to be understood. When a ham cranks that devilish instrument all the way up then he starts QRMing his own signal. One can hear the fans running, dogs fighting on the street, and even the stomach rumbling. All this is creating splatter that gives a very bad image of the ham and his station.

It is quite simple to adjust the gain just by observing the plate or rf meter on your transmitter or amplifier. When you press push-to-talk without saying anything, the meter should not move. If you are getting more deflection on the meter when you are not talking than when you are talking, then obviously it is a bit too much. Another situation is bad neutralization, which creates all kinds of spurious signals inside and outside the bands, including terrific TVI. Also watch for a wrong bias adjustment on your PA amplifier or transmitter. That could put your rig into Class C, and there you have another factor contributing to your beautiful signal.

Why all of this? Well, if you listen around you know why. The garbage level on the bands is very high. It doesn't take too many stations to wipe out the band and make it impossible for others to hear that XZ9A who is trying to call you.

The same goes for the DX pileups. Gone are the days when you could pick the callsigns out of the pile because they were clean and understandable. Three bad stations can wipe out half a band and make it difficult for the DX station to hear anyone.

We consider ourselves gentlemen, so let's do it right and be proud of our signals!



Typical Big Gun Contest (and DX) station of KØRF. Cement blocks and boards serve as an operating desk, not for the great looks but for the super-efficient layout of three rigs and all the other gadgets. Outside are three 200-foot towers with assorted high-performance antennas. Chuck KØRF (left) is discussing strategy with George WØUA before an upcoming contest. George is a frequent high scorer in sweepstakes and holds a number of records.

BULLETIN OF THE MONTH

This time we look at another weekly DX bulletin from across the pond. It is the continuation of the old and famous Geoff Watts bulletin, still edited by him, published by the RSGB, and called *DX News Sheet*. It is getting close to its 1000th issue. It lists activities and expected operations, has QSL information, and gives upcoming contest rules. The sample shows the arrangement.

DX NEWS

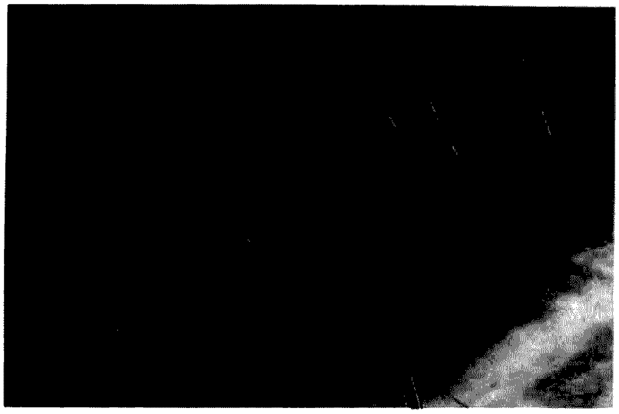
A6XJA, United Arab Emirates, showing up on 15m around 21.200. Operator is Jan-Keur; QSL via PAØLP or direct: PO Box 2730, Abu Dhabi, United Arab Emirates. A6XJC keeps occasional schedules with WB2OHD near 28.688 for short lists around 1500/1530 GMT. Claiming valid license and expects to be there for some time. QSL via PEØMGM.

A9XDO, Bahrain. Operator Howard showing up on 28.607 at 1545, 14.236 at 0200, 14.020 at 0345. QSL via KA4S. A9XDA, Paul, around 14.182 at 0200; QSL via N4BPP.

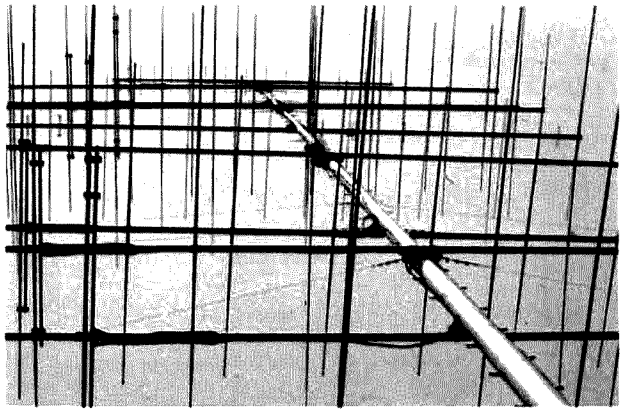
A22ZM, Botswana. Mark is now in South Africa; QSL via ZS5CU. A22VL will be on the air for about two years, operated by W9VL, showing up in the major contests and some DXpeditions.

BV2A, Taiwan. Tim is back on the air after the hurricane season. He takes the antennas down himself, rather than let Mother Nature do it. QSL direct.

CEØX, San Felix Island. Wow! Bob Read KF1O, ex-WB1GDQ, received his Extra class US license just in time for this historical operation. Both "partners," WØAX and N4CBL, have bowed out of the operation and Bob fired up from CEØX quite quickly. While some were figuring that it would take him a day or so by boat, he managed to get there by air and surprised the world by showing up on 15m for a few QSOs. Later he operated on 20 and 10m also. Apparently, there were only a few hours of



Ever wondered what hit you in the pileup? The answer is in the antennas. This is the VE3BMV Razor Beam, just going up on the top of the 110-foot rotatable pole. It has 4 quad elements (2 driven) and three yagi elements on a 60-foot boom. And there are two of them stacked. They really cut through the pileup and give the edge!



This one is at the "Papa Victor" antenna farm—the W2PV multi-multi station. Stacked Telrex beams on the 110-foot Big Bertha. The configuration reads, from top down: 6 elements on 20, 8 on 15, 10 on 10, 3 on 40, and, again, 10 on 10, 8 on 15 and 6 on 20. That surely gets respect on the band! So, the next time you can't hear the one they are working, don't worry about it (unless you have more elements up there).

operation his work permitted. The pileups were much worse than Clipperton has experienced. Poor list operators, they did not get the chance. Job well done, considering the restrictions that Bob was faced with. About 700 contacts were made, mostly with US stations. There is some chance he might be invited back and be able to do some more operating. QSL to his SVØBV address: Box 564, Athens, Greece.

FB8WG, Crozet Island. George is operating as much as his schedule is permitting him. He should be there for about 9 months. Usually showing up on the French net on 14.170 or 21.170 at 1800Z. Operating list on weekends around 21.279 from 1200Z. QSL via F2CL. Another one who operates with the help of the list "undertakers." Hoping to get the vfo and operate on his own.

FPØGBG, St. Pierre and Miquelon. Operation by Al W8AH. Also FPØGAP by W8NR, FPØGAO by K8CJQ. QSL to their home calls.

HS, Thailand. Thai radio amateurs are back on the air. Apparently they were off because they had to register their rigs. The same old callsigns are still assigned, so there is no change. Dr. George Collins VE3FXT is supposed to be back in HS for some more tests and demonstration of coherent CW, and is hoping to get on from XZ—Burma.

HV, Vatican and Radio Vaticana, is celebrating the 50th anniversary and offering an award for working several amateurs there. Stations in Europe and the USA must work two of the three stations, all others need work only one. The calls are HV3SJ, HV1CH, HV2VO. Starting date was October 1 and it runs until February 1, 1982. Send photocopy of QSL card to Radio Vaticana, Citta del Vaticano, Europe.

T3, Kiribati. The following are separate countries for the DXCC: T30—Western Kiribati (Gilbert or Ocean Island), ex-T3A or VR1; T31—Central Kiribati (British Phoenix Island), ex-T3P, VR1; T32—Eastern Kiribati (Christmas or Line Island), ex-T3L, VR3. Recently active: T32UF around 21025 at 0230; QSL via JA1NVG. T32AB around 21298 at 0300; QSL via N7YL.

V3A, Belize. This is the new prefix and not J9 as previously announced and expected. This should replace the old VP1 prefix in the callsigns. VP2A Antigua is expected soon to become V2A.

XZ, Burma or Karen State? According to JA8BMK and most people, these should be recognized as separate DXCC countries—that is, as XZ9A and XZ5A. There was some activity reported by other stations with XZ2 and XZ1 callsigns operating from Rangoon, Burma.

1AØKM, SMOM or Sovereign Military Order of Malta, was finally accepted by the ARRL as a separate country for DXCC. This brings the current total back to 319. They were supposed to be in the CQ WW contest but it was a no show. QSL cards are being accepted after January 1, 1982, for all the contacts made with 1AØKM.

3X1Z, Guinea was on again by Jacques W4LZZ on October 11-23. QSL via W4FRU.

5A7BQ, Libya. Operator Abed is active around 28546 at 1700 and claims to be a permanent resident with a valid license. QSL via Box 733, Benghazi, Libya.

5R8, Malagasy Republic, activated by Luigi IV3OSHN/5R8 between September 20-28; QSL via IV3MUC. 5R8AL is active around 28535 at 1730, QSL via WA4VDE.

7O1AB, South Yemen, could be on at any time. J28AZ is the holder of the license and it is supposed to be a matter of picking it up and operating. (We have been hearing about this for six months.)

AWARDS

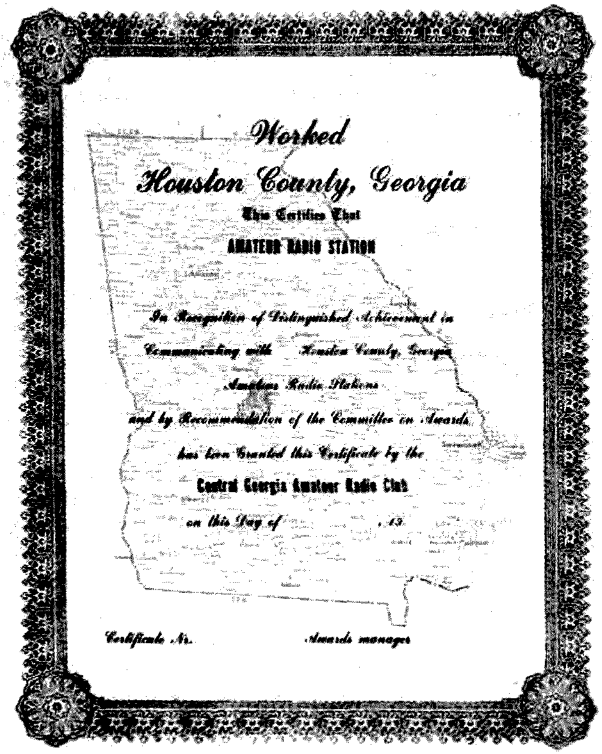
Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

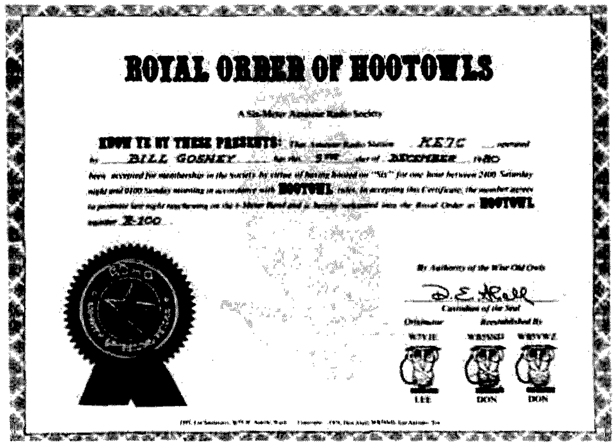
W2JIO NAMED AS 1980 ARMSTRONG PIONEER

Bob Gunderson W2JIO has been voted the first recipient of the annual Armstrong Memorial Award. It was given to him in recognition of his outstanding contributions to amateur radio via his work with and for blind hams. Bob, who was born blind himself, has designed and built many kinds of test instruments with audio outputs as well as other methods of working with electronics for the sightless. He also founded the Braille Technical Press, and taught electronics for 37 years at the New York School for the Blind, directing many students toward rewarding careers in electronics.

The award was presented at the 1980 ARRL Hudson Division Convention. Bob could not be present, so a tape recording of this event was sent to him along with the plaque.

The award, a sort of "Most Valuable Player" of amateur radio, honors the memory of Major Edwin Armstrong, inventor of frequency modulation and other technical advances which have benefitted amateur radio. It will be given each year to one ham for his or her outstanding service to the amateur community. Some of the nominees for 1981 are Copthorne MacDonald W4ZII, father of SSTV, Don Stoner W6TNS, driving force behind the original OSCAR program, and HRH Hussein, JY1,





for his help in promoting the concept of amateur radio throughout the Mideast. If you would like to nominate someone, just send a note to Awards Committee, Major Armstrong Memorial Amateur Radio Club, Box 1234, Englewood Cliffs NJ 07632.

SPECIAL EVENTS STATION FOR LEWIS AND CLARK WINTERING SITE

A Special Events station will be sponsored by the Mandan-Bismarck Amateur Radio Club on January 2 and 3, 1982. There will be a distinctive OSL card this year, featuring Sakakawea, the Indian maid who led the expedition to the West Coast.

Time of operation will be 1600-2100 UTC on both days. Frequencies to be used: SSB—14295, 21395, 28595; CW—14065, 21065, 28065; and Novice—21125, 28125. All frequencies plus-minus QRM.

To receive the special commemorative QSL card, send an SASE to the Mandan-Bismarck Amateur Radio Club, PO Box 978, Bismarck ND 58501. (For additional information, you may contact Ed Drewello WB0OFW at the same address, or call (701)-223-0150, Ext. 124.)

THE WORKED HOUSTON COUNTY GEORGIA AWARD

The Central Georgia Amateur Radio Club of Warner Robins, Georgia, is proud to announce the establishment of the Worked Houston County Georgia Award.

The requirements for obtaining this handsome, three-color award are:

- US stations are required to contact five (5) amateur stations in Houston County. Stations in Houston County need ten (10) contacts with other amateur stations in Houston County.
- DX stations are required to contact three (3) amateur stations in Houston County, Georgia.
- All contacts must be made on the 10-through-160-meter amateur bands. Endorsements for single band, single mode, etc., will be honored upon request.
- All contacts must have been made February 14, 1981, or later.
- The fee for this award is $1.00 plus two (2) first-class stamps for US stations. DX stations please send four (4) IRCs. Send fee and list of claimed contacts (no QSL cards) with complete log information to: Awards Manager, Manuel Matta WD4ENO, 619 American Boulevard, Warner Robins, GA 31093, USA.

ROYAL ORDER OF HOOTOWLS

The Royal Order of Hootowls became a society in June of 1955 with the "gag" nomination and hand-drawn owl being sent to John Woods W7TMI, after burning the midnight oil with the originator, Lee Singleterry, Sr. W7YJE. Dick W7VIC, Gordy W7UFE, and Tad W7WZK rounded out the charter membership, and the granddaddy of 50-MHz societies was born!

The Order became dormant with the passing of Lee, but in 1977, Don Abell WB5SND located Mrs. Singleterry and was granted permission to reestablish the Order once again. This was completed in 1978 in partnership with Don Verlander WB5VWZ.

The Order is not a net but a society founded to promote friendship and goodwill toward amateurs everywhere, and was developed to enhance and preserve activity on the late Saturday night 6-meter ragchew.

ROHO membership is open to any licensed amateur who meets the following conditions:

- All contacts must be made on the 6-meter band and must be point-to-point; contacts by relay are not valid.
- Call "CO Hootowls" on 50.200 at midnight (2400) local time on Saturday night only.
- Establish and maintain two-way contact with a member station for a minimum of one full hour starting at 2400 Saturday night and ending not earlier than 0100 Sunday morning. DX stations may qualify by making contact with an Owl at *any time* during the above stated period.
- To apply for the affiliation and membership certificate, submit the name, callsign, ROHO number of the member station worked, and the date worked, along with your own name, address, and callsign. There is a one-time membership fee of $2.00.

Make your check payable to Don Abell, 6821 West Avenue, San Antonio TX 78213.

ROMANTIC ROAD AWARD

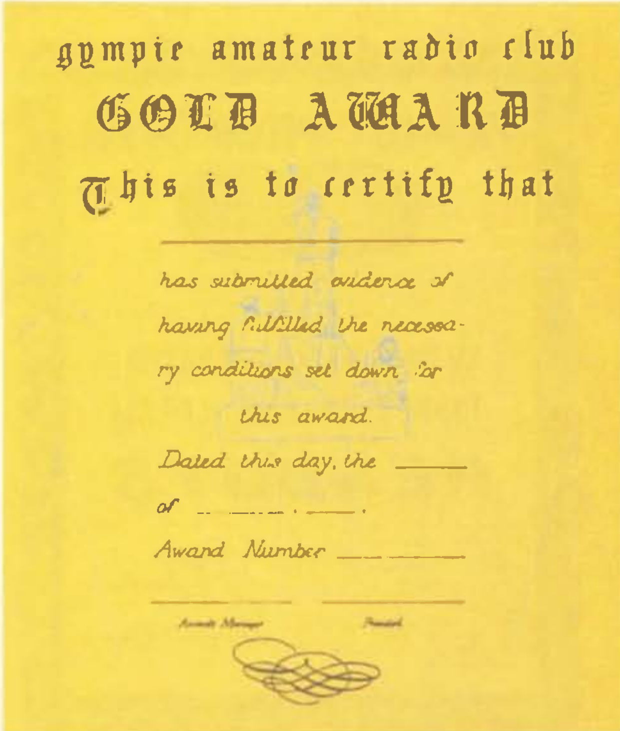
The local group (OV) Nordlingen of the German Amateur Radio Club issues this award on the occasion of its Jubilee (25th year) to all licensed radio amateurs and SWLs for contacts with stations along the "Romantic Road," located in Wurzburg, Tauberbischofsheim, Bad Mergentheim, Creglingen, Rothenburg o.d. Tauber, Feuchtwangen, Dinkelsbuhl, Nordlingen, Harburg, Donauworth, Augsburg, Landsberg, Schongau, Schwangau, and Fussen.

List of DOKs valid for the award: A 23; B 02, 17, 18, 22; C 20, 21; P 25; T 01, 06, 09, 11, 17, 21; Z 30, 52.

Requirements: Each QSO with stations along the Romantic Road will count 1 point, each CW QSO 2 points, and each RTTY QSO 3 points. Contacts with members of the "OV" Nordlingen, DOK T 09, count double points. European stations need 50 points, and VHF and DX stations need 25 points.

This certificate is also available to SWLs.

The fee: DM5, US$4, or 10 IRCs. Send to Friedl Schrey, PO Box 1, D-8855 Wemding, W. Germany.



WORKED ALL BOWIE AWARD

The Bowie Maryland Amateur Radio Club is offering the Worked All Bowie Award to amateurs who make contact with stations located in this Washington DC suburb.

The Bowie Award is issued in two classes: Class 1 for contacts with four stations located in the city and Class 2 for two contacts within Bowie. DX stations, to qualify, must work two Bowie amateurs for Class 1 recognition and work one station within Bowie for Class 2.

There is no fee for this award, but applicants are requested to accompany their log extracts with a large (#10) self-addressed stamped envelope. Forward your applications to: John Rouse KA3DBN, PO Drawer M, Bowie MD 20715.

GARRETT ISLAND AWARD

The Bowie, Maryland, ARC is still offering the Garrett Island Award to any amateurs who worked K3PI during the mini-DXpedition to this uninhabited island located near the Chesapeake Bay in Cecil County, Maryland. A second large SASE to John Rouse KA3DBN, PO Drawer M, Bowie MD 20175 will get you the award. By the way, QSL cards *are* required as proof of contact.

LINCOLN TRAIL AWARD

The Lincoln Trail Amateur Radio Club, Inc., will be holding an in-state DXpedition from Abraham Lincoln's birthplace in Hodgenville, Kentucky. Hodgenville is located in LaRue County.

The expedition will be on February 13 beginning at 0000 UTC. The station call will be NN4H. Planned frequencies are: Phone—15 kHz from bottom of the General phone band; CW—15 kHz from bottom of the General CW band; Novice—15 kHz down from top of band edge. For certificate, send an SASE to Charlie Myers, PO Box 723, Elizabethtown KY 42701.

FREEZE YOUR ARCTIC OFF CERTIFICATE

The Tin Lizzies are at it again! The fourth annual Freeze Your Arctic Off expedition will take place between 1700Z January 23 and 1800Z January 24, 1982, using a twenty-mile-wide frozen lake as the ground plane for our phased vertical array. As in the past, a handsome certificate will be sent to all QSLed contacts. No SASE is needed, but *please put your contact number on your card.*

Look for AD8R/8 on 7.275, 21.380, 146.55, and 146.58 MHz out on the frozen wastes of Lake Saint Clair near the US-Canadian border. QSL to Box 545, Sterling Heights MI 48077-0545.

ROBBINSDALE ARC OPERATION ICEBOX

The Robbinsdale Amateur Radio club (KØLTC) is proud to announce its second Annual Operation Icebox from the frozen surface of Rainy Lake, near International Falls, Minnesota. Operation will begin on February 5, 1982, at 0000 GMT and run till February 6, 1982, at 0000 GMT. The frequencies used will be 10 kHz up from the bottom of the General Phone bands. Novice operation also is planned. There will be two operating stations to cover 80m through 10m. KØLTC is offering an attractive 8½ × 11 commemorative QSL of the event to all who enclose an SASE (business size) with their card. The QSL route is via KBØPM, club president.

GYMPIE AMATEUR RADIO GOLD AWARD

The Gold Award is open to all licensed amateur radio stations and shortwave listeners. Stations must obtain ten (10) points by working Gympie Amateur Radio Club members. Overseas stations need obtain only five (5) points for qualification.

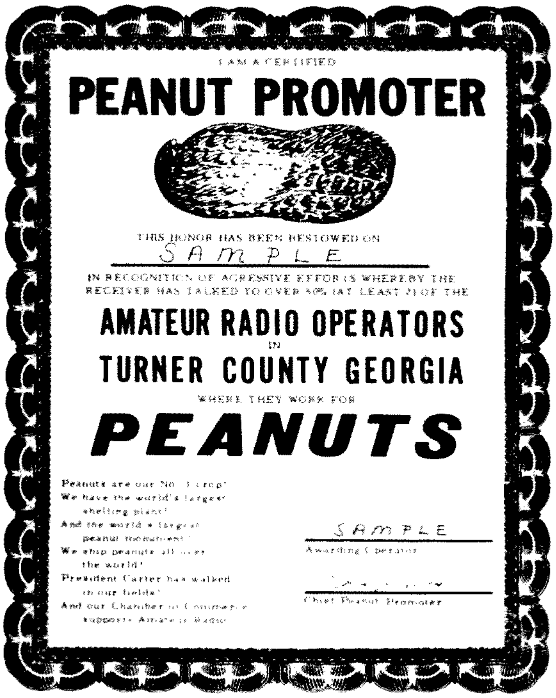
Stations can be worked on any band using any mode. Active modes are: SSB, CW, FM, AM, and RTTY. Contacts on HF count as one (1) point each. Contacts on VHF (52 MHz and up) are worth two (2) points each. A contact with the club station (VK4WIH) counts as two (2) points on any band. Contacts via repeaters are not valid.

Stations can be worked once on each band. QSL cards are not required. Applicants must send a log extract containing all relevant information (date, time, frequency, mode, signal report, callsign). Contacts after October 13, 1980, are valid.

Domestic cost of the award is $1.00 or three IRCs. Overseas stations: $2.00 or five (5) IRCs. Address the Awards Manager, Gympie Amateur Radio Club, PO Box 384, Gympie, Qld., 4570, Australia.

PEANUT PROMOTER AWARD

This award is sponsored by the Turner County Chamber of



Commerce in conjunction with the Coastal Plains Amateur Radio Club based in Ashburn, Georgia.

To qualify for this award, an applicant must work at least two stations in Turner County, Georgia. Both QSL cards received from these contacts must be sent to the Awards Manager along with an SASE.

Actually, the club has two managers for this award. If your contact was made on six meters, then forward your application to: "Fuz" Tanner WA4NTF, Route 2, Box 351, Ashburn GA 31714. If your contacts were made on any other band, send your application to Wayne Harrell WD4LYV, Route 1, Box 185, Sycamore GA 31790.

I am not sure if there is a fee for this award—the award rules failed to mention any remittance. To be safe, however, I would enclose a minimum of $2.00 to cover the club's expenses.

VERNON BC WINTER CARNIVAL CERTIFICATE

We of the North Okanagan Radio Amateur Club (NORAC), along with the Vernon Winter Carnival Society, are sponsoring a certificate this year to celebrate the 22nd Annual Vernon Winter Carnival, western Canada's largest winter carnival, held annually in February. This year the carnival is being held February 5-14.

We will be operating daily from 2100-2400 Zulu, and on February 7 from 2000-0200Z. This is a free award, and all you need to do is send the log information of QSOs with three (3) Vernon area stations or one contact with the club station (VE7NOR) to PO Box 1706, Vernon BC V1T 8C3. (Vernon area is defined as Armstrong, Enderby, Oyama, Winfield, Lumby, and Vernon.) Frequencies to watch are: 28.575, 21.375, and 14.295 plus or minus QRM, with possible CW and RTTY operation also.

The award is available year-round; all QSOs are valid.

CQ CQ CQ . . . HIGH SCHOOL AND COLLEGE CLUB STATIONS

The McKinley High School Amateur Radio Station (KH6NF) is trying to make contact with teenagers and young adults around the world. McKinley High is the oldest public high school in the state of Hawaii, being 116 years old this school year. We are located in Honolulu, just minutes away from the famous Diamond Head crater and Waikiki Beach. Our student population is just over 2000, and it rivals the United Nations with our diversity of cultural and national heritages.

The club station has been in operation since 1966, but this year we are making a special effort to contact other club stations and younger members of the amateur radio society. We are inviting everyone to join us on the bands and make this year an outstanding one for youthful hams.

Our hours of operation will be from 1730Z to 1815Z and 0045Z to 0115Z Monday through Friday, and 2000Z to 2130Z Monday, Wednesday, and Friday. At present, we operate on 10 meters, 28.520 MHz ± QRM. If 10 meters closes up, we will operate 21.420 MHz or 14.320 MHz.

If you are unable to contact us because of poor band conditions, please drop a line to set up a schedule and we will do our best to have a QSO with you. Our address is McKinley High School Amateur Radio Station, 1039 S. King Street, Honolulu HI 96814. Until we meet you on the air . . . Aloha!

WORKED ALL HAWAII AWARDS

Sponsored by the Big Island Amateur Radio Club, these awards are available to all licensed amateurs. Contacts made after 0000Z January 1, 1982, are valid for the awards.

Any mode on any band is acceptable. No terrestrial repeater contacts will be accepted, and only land-based stations are valid for the awards.

Do not send QSL cards. A list showing the date, time, signal report, mode, callsign, and band, certified by a club or society official, is sufficient.

The fee for any award is US $3.50; three awards are available: Class A—Wood-carved tiki (certificate only for stations located in the State of Hawaii); Class B—Certificate; and Class C—Certificate.

Class A requirements: Work 100 Hawaiian stations, to include (A) the islands of Hawaii, Maui, Lanai, Molokai, Oahu, and Kauai; (B) the counties of Hawaii, Maui, Kalawao, Honolulu, and Kauai; (C) one of the following islands: Kure, Midway, Necker, Laysan, French Frigate Shoals, Niihau, or Kahoolawe, and (D) 10 or more BIARC members.

Class B requirements: Work 50 Hawaiian stations, to include the islands of Hawaii, Maui, Molokai, Oahu, and Kauai, and 5 or more BIARC members.

Class C requirements: Work 25 Hawaiian stations, to include the islands of Hawaii, Maui, Oahu, and Kauai, and 3 or more BIARC members.

Address all award applications to the Big Island Amateur Radio Club, PO Box 1688, Kamuela HI 96743.

Take your favorite H.T. out for a drive tonight.

VISA or MASTERCARD for same day shipment

For $64.95 you get the most efficient, dependable, fully guaranteed 35W 2 meter amp kit for your handy talkie money can buy.

Now you can save your batteries by operating your H.T. on low power and still get out like a mobile rig. The model 335A produces 35 watts out with an input of 3 watts, and 15 watts out with only 1 watt in. Compatible with IC-2AT, TR-2400, Yaesu, Wilson & Tempo! Other 2 meter models are available with outputs of 25W and 75W, in addition to a 100W amplifier kit for 430MHZ.

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Communication Concepts Inc. 2648 N. Aragon Ave., Dayton, OH 45420 (513) 296-1411

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

HUNTING LIONS IN THE AIR CONTEST

Starts: 1200 GMT January 9
Ends: 1200 GMT January 10

The contest is sponsored by Lions Clubs International and coordinated by Lions Club Rio de Janeiro Arpoador, Brazil. Participation in the contest is open to all duly-licensed radio operators, Lion and non-Lion. There are two modes—phone and CW. Participation in both modes is allowed but points are counted separately. All amateur stations participating must operate within their licensing regulation. Separate categories will exist for single operator and radio clubs/societies. Multi-operators may participate, but each prefix must be listed on the log.

Use all bands, 80 through 10 meters. Only one QSO with the same station on each band may be counted. Remember that phone and CW are counted separately!

EXCHANGE:

RS(T) and sequential QSO number. When contacts are made with Lions and Leos, the name of the Lions Club or Leo Club contacted should be clearly identified.

SCORING:

QSOs within the same continent count 1 point while those between different continents count 3 points. Score 1 extra bonus point for each QSO with a member of a Lions Club or Leo Club and 5 points for a QSO with a member of the Lions Club Rio de Janeiro Arpoador. Contacts between Brazilian stations and members of the Arpoador club will count only 2 extra points.

AWARDS:

Lions Club International will present trophies for first, second, and third place on both modes in both categories. Fourth through tenth places will receive plaques. In addition, each log sent by participants, radio clubs, or radio societies with a minimum of 5 contacts will receive a special certificate. The contest committee also will select and award the most active Lions Club participating in the contest.

ENTRIES:

Keep a separate log for each mode. Each participant will note in the logs the callsign and information exchanged. Confirmation of contacts will be made by comparing the logs of the participants. Participants should send their logs not later than 30 days after the contest to: Contest Committee—Hunting Lions in the Air, Lions Club of Rio de Janeiro Arpoador, Rua Souza Lima #149, Apt. 402, 22081 Rio de Janeiro, RJ, Brazil.

WORKED ALL MORTON CONTEST

0001 GMT January 9 to 2400 GMT January 10 and 0001 GMT January 16 to 2400 GMT January 17

The Worked All Morton Award will be issued to those hams who have QSOs with five or more members of the Morton Amateur Radio Club or residents of Morton, Illinois, during the contest periods. To receive the award, applicants should send log information listing at least five Morton contacts along with a large SASE to: Morton ARC, 701 Columbus Ave., Morton IL 61550.

TEXAS QSO PARTY

Starts: 0000 GMT January 23
Ends: 2400 GMT January 24

Sponsored by the West Texas Amateur Radio Club of Odessa, Texas. Use all bands and modes. Each station may be worked on each band and each mode. Mobiles may be worked again upon each county change. Single-operator entries only. CW QSOs must be in CW subbands only.

CALENDAR

Jan 1	**ARRL Straight Key Night**
Jan 2-4	**Zero District QSO Party**
Jan 9	**Hunting Lions In The Air Contest**
Jan 9-10	**73's 40- and 80-Meter Phone Contest**
Jan 9-10	**Worked All Morton Contest**
Jan 16-17	**73's International 160-Meter Phone Contest**
Jan 16-17	**International SSTV Contest**
Jan 16-17	**Worked All Morton Contest**
Jan 23-24	**Texas QSO Party**
Jan 23-24	**Great North Dakota QSO Binge**
Jan 29-31	**CQ WorldWide 160-Meter Contest—CW**
Jan 30-Feb 7	**ARRL Novice Roundup**
Feb 6-7	**RSGB 7-MHz Contest—Phone**
Feb 6-7	**South Carolina QSO Party**
Feb 20-21	**ARRL DX Contest—CW**
Feb 26-28	**CQ WorldWide 160-Meter Contest—SSB**
Feb 27-28	**RSGB 7-MHz Contest—CW**
Mar 6-7	**ARRL DX Contest—Phone**
Jun 12-13	**ARRL VHF QSO Party**
Jun 26-27	**ARRL Field Day**
Jul 10-11	**IARU Radiosport**
Aug 7-8	**ARRL UHF Contest**
Sep 11-12	**ARRL VHF QSO Party**
Nov 6-7	**ARRL Sweepstakes—CW**
Nov 20-21	**ARRL Sweepstakes—Phone**
Dec 4-5	**ARRL 160-Meter Contest**
Dec 11-12	**ARRL 10-Meter Contest**

RESULTS

1981 TEXAS QSO PARTY

Texans

K5IID	53,413**
KB5FP	37,635*
KG5U	20,580
W5SOD	13,502
WN5MBS	12,903
WA5WDB	9,702
N5QQ	9,065
W9ZTD/5	8,977
WB5QWW	8,200
W5ONL	7,942
WB5DBT	7,733

Mobile Texans

WD5ACR	9,840*
K3ZMI/5	8,000

DX

I6FLD	861*
CT1BY	646
G4HBI	392

Stateside

AE3Y	26,260*
WB2GEX	4,655
W3HDH	3,105
N4AOC	2,070
K4DDB	1,241
K1BV	1,027
WD9FNB	897
W6SZN	876
W2IMO	722
WD8NHN(N)	684
W7LN	400
KA0CLS	366
WB0UCP	360
KB8KW/7	294
WA5DTK/M4	280
K7EQ	279
WB1GLH	250
W8EAO	240
K9GDF	230
WA4YUU	112
KA0GMU	88
WB4WHE	21

Canada

VE1RQ	882*
VE3KK	480

*Plaque. **Contest chairman—ineligible for awards. All others, certificate winners.

EXCHANGE:

QSO number (beginning with 001) and state, province, country, or Texas county.

FREQUENCIES:

Novice—3710, 7110, 21110, 28110; Phone—3940, 7260, 14280, 21370, 28600; CW—3565, 7065, 14065, 21065, 28065.

SCORING:

All non-Texas stations score points as follows: phone contact with fixed station in TX = 1 point; CW contact with fixed station in TX = 2 points; phone contact with mobile station in TX = 5 points; and CW contact with mobile station in TX = 7 points. Multiply by the number of Texas counties worked (254 max.).

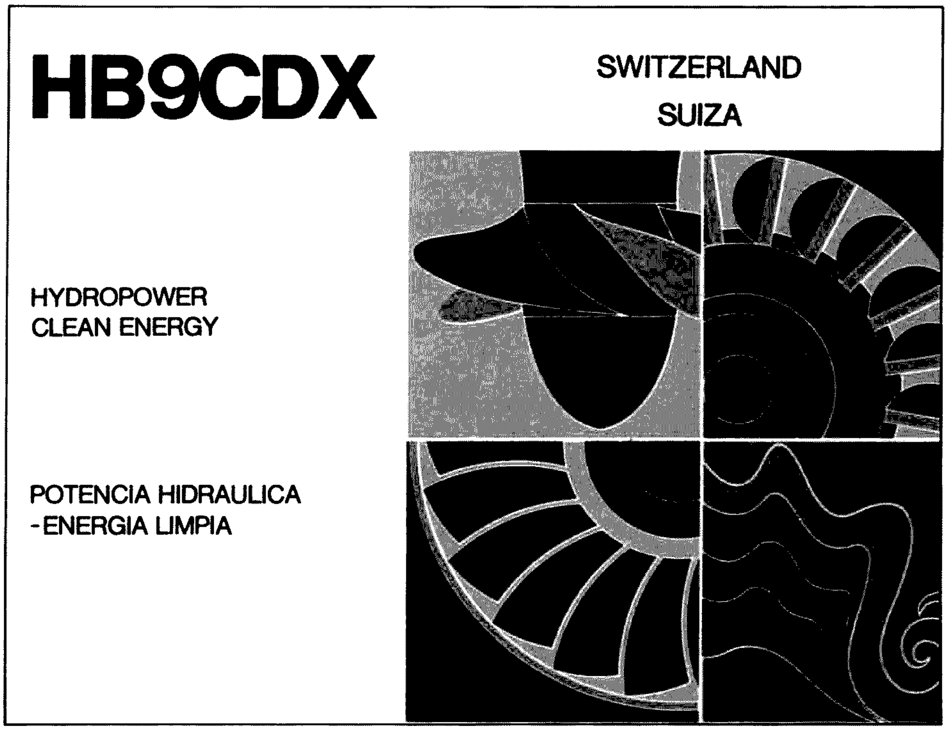
All Texas stations score 1 point per contact on phone, 2 points on CW regardless of fixed or mobile. Multiply by the number of states, countries, and Canadian provinces worked.

AWARDS:

Plaques to top scores: US, US-Novice, DX, Canada, Texas fixed, Texas mobile, Texas Novice. Certificates to top score in each state, country, and province. Certificates also to top 10 Texas stations. Special awards as activity dictates.

ENTRIES:

All logs must be received by March 15th. Mail entries to: WTARC, PO Box 9944, Odessa TX 79762-0041.



QSL OF THE MONTH: HB9CDX

This colorful card was submitted by Swiss amateur Hans K. Wagner HB9CDX. It's an example of how your card can reflect a personal interest—in this case, hydroelectric power.

If you would like to enter our contest, put your QSL card *in an envelope* and mail it, along with your choice of a book from *73*'s Radio Bookshop, to *73 Magazine*, Pine Street, Peterborough NH 03458, Attention: QSL of the Month. Entries which do not use an envelope (the Postal Service does *occasionally* damage cards) and do not specify a book will not be considered.

THE GREAT NORTH DAKOTA QSO BINGE

0000 to 0800 and 1600 to 2400 GMT January 23, and 0800 to 1600 GMT January 24

Sponsored by the Red River Radio Amateurs of Fargo, North Dakota.

EXCHANGE:

RS(T) and state, country, or North Dakota county. Novices, please indicate Novice status.

FREQUENCIES:

Phone—1815, 3905, 7280, 14280, 21380, 28580; CW—1810, 3540, 7035, 14035, 21035, 28035; Novice—3725, 7125, 21125, 28125. All frequencies plus or minus 10.

SCORING:

Phone contacts count 10 points, CW count 20, and RTTY

NEWSLETTER CONTEST WINNER

W9CCU — WHEATON COMMUNITY RADIO AMATEURS

HAMLETTER

Picking a monthly winner for *73's* Newsletter Contest is no easy task. There are literally hundreds of entries to sift through. Each month we narrow the field to four or five outstanding publications and then make the tough decision.

Almost without fail, each month's collection of runners-up has included at least one newsletter from a Chicago area club. For some reason unknown to us, the newsletters coming from that part of the country are usually first-rate. Perhaps there is some sort of inter-club rivalry? This month, a nineland publication finally clawed its way to the top, with the winner being *The Hamletter*, published by the Wheaton Community Radio Amateurs.

This suburban Chicago group's newsletter sports a two-color printing job on the front page and is chock full of black and white photos. But in the end it was a rather small detail that brought victory to *The Hamletter*. Should a copy of this publication fall into the hands of someone who is not a club member, he or she will find plenty of information about the club. A collection of helpful facts can be found every month on the newsletter's masthead. In addition to listing the names and calls of the club officers and newsletter staff, you'll find a mailing address for the club, details about the club meeting time and place, plus a rundown on the club nets and repeaters. This may seem like "obvious" information but for any new or prospective member it can be indispensable.

A newsletter is built from a collection of little details like the masthead. Sometimes you can make subtle changes in your style or layout that will outstrip the improvements of a major reorganization. Establishing a regular format for a publication can give it an identity, but sticking to something because "it's always been that way" may lead to stagnation. Perhaps in 1982 your club can concentrate on the little things; sometimes they make the biggest difference. Keep those newsletters coming!—N8RK.

1st ANNUAL 40- AND 80-METER PHONE CONTEST

SPONSORS:
73 Magazine, Peterborough, New Hampshire 03458

CONTEST PERIODS:
40-Meter Event—0000Z to 2400Z January 9, 1982
80-Meter Event—0000Z to 2400Z January 10, 1982

MISCELLANEOUS RULES:
Work as many stations as possible on 40- and/or 80-meter phone during the specified times of allowable operation. The same station may be worked once on each band. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours on each band. All multi-operator stations may operate the entire 24-hour period on each band. Off periods must be noted in your logs and on your summary sheet. Off periods are no less than 30 minutes each.

OPERATOR CLASSES:
(A) Single-operator, single transmitter, phone only
(B) Multi-operator, single transmitter, phone only

ENTRY CATEGORIES:
(1) 40-meter band only
(2) 80-meter band only
(3) 40- and 80-meter bands

EXCHANGE:
Stations within the continental US and Canada transmit an RS report and state, province or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:
A station may be worked once on each band. US/VE stations earn 1 QSO point per contact with the 48 states and Canada, 2 points for all others. DX stations (including Alaska and Hawaii) earn 1 QSO point per contact within your own country, 2 points for all others. Contacts made between 1000 and 1400 local time score twice the normal points per contact. Indicate points per contact on your log sheet.

MULTIPLIERS:
1 multiplier point is earned for each US state (48 max.), each Canadian province or territory (12 max.), or each DX country worked on each band.

FINAL SCORE:
Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:
Each contest entry must include a log for each band in your entry category, a dupe sheet for each band, a contest summary, and a multiplier checklist for each band. We recommend that contestants send for a copy of the contest forms. Enclose an SASE to the contest address listed below.

ENTRY DEADLINE:
All entries must be postmarked no later than February 11, 1982.

DISQUALIFICATIONS:
Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

AWARDS:
Contest awards will be issued in each entry category in each of the continental US states, Canadian provinces and territories, and each DX country represented. A minimum of 5 hours and 50 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:
Send an SASE to: Whidbey Island DX Club
2665 North Busby Road
Oak Harbor, Washington 98277

count 50. North Dakota stations count an additional 100 point bonus for working five Novices. North Dakota stations multiply score by total of states, provinces, and countries per band and mode. Others multiply by counties worked per band and mode (max. of 53 counties).

ENTRIES AND AWARDS:

Certificates to state and province winners. Plaque to North Dakota winner. Mail logs with usual certification by February 28th to: Bill Snyder WØLHS, Box 2784, Fargo ND 58108-2784.

CQ WORLDWIDE 160-METER CONTEST—CW

Starts: 2200 GMT January 29
Ends: 1600 GMT January 31

EXCHANGE:

RST plus a three-digit contact number starting with 001. US stations include state and Canadians include province.

SCORING:

US and Canadian stations count 2 points per QSO with other W/VE/VO stations; DX contacts are 10 points each.

DX stations count 2 points per QSO with stations in the same country, 5 points with stations in other countries. QSOs with W/VE/VO stations are 10 points each.

All stations count one multiplier point for each US state, VE province, and DX country. KH6 and KL7 are considered DX. Final score is total QSO points times the sum of multipliers.

AWARDS:

Certificates to the top scorers in each state, VE province, and DX country. Additional awards if the score or returns warrant.

Two plaques are being awarded by the West Gulf ARC, both for single operators—one for the highest scoring US station and the other for Europe. The World Champion in the contest will receive the John Doremus WØAW Memorial Plaque from friends of WØAW. This plaque can be won only once by the same station in a three-year period.

PENALTIES:

Three additional contacts will be deleted from the score for each duplicate, false, or unverifiable contact removed from the log. A second multiplier also will be removed for each one lost by this action.

Violation of the rules and regulations pertaining to amateur radio in the country of the contestant or the rules of the contest, or unsportsmanlike conduct or taking credit for excessive duplicate contacts or multipliers will be deemed sufficient cause for disqualification. Disqualified stations or operators may be barred from competing in *CQ* contests for a period of up to three years.

ENTRIES:

Sample log and summary sheets may be obtained from *CQ* by sending a large SASE with sufficient postage to cover your request. It is not necessary to use the official form; you may use your own. Logs should have 40 contacts per page, show time in GMT, and numbers sent and received; there should be separate columns for QSO points and multipliers. Indicate the multiplier only the first time it is worked.

Mailing deadline for CW entries is February 28th. Logs can

3rd ANNUAL INTERNATIONAL 160-METER PHONE CONTEST

SPONSORS:
73 Magazine, Peterborough, New Hampshire 03458

CONTEST PERIOD:
0000Z January 16, 1982, to 2400Z January 17, 1982

OBJECT:
To work as many stations as possible on 160-meter phone in a maximum of 36 hours of allowable contest time. Multi-operator stations may operate the full 48-hour contest period. Stations may be worked only once!

ENTRY CATEGORIES:
(1) Single operator, single transmitter, phone only (2) Multi-operator, single transmitter, phone only

EXCHANGE:
Stations within the continental US and Canada transmit RS report and state, provinces or territory (i.e., 59 Iowa, 55 Ontario, etc.). All others transmit RS report and DX country.

POINTS:
Five (5) points will be earned for each valid contact with stations in the continental US and Canada. DX contacts outside the continental US and Canada score ten (10) points each. This year for the first time, an additional 5 points ***bonus*** may be earned for each contact made during the hours of *1000-1400 local time* on either day of the contest.

MULTIPLIERS:
1 multiplier point will be earned for each of the 48 continental states, twelve (12) Canadian provinces/territories, and DX countries outside the continental US and Canada worked during the contest.

FINAL SCORE:
Total OSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:
Each contest entry must include logsheets, dupe sheets for 100 contacts or more, a contest summary sheet and a multiplier check sheet. Please note those contacts made between 1000-1400 local time so you'll be sure to get appropriate contest credit.

ENTRY DEADLINE:
All entries must be postmarked *no later than February 18, 1982.*

DX WINDOW:
Stations are expected to observe the DX window from 1.825-1.830 MHz as mutually agreed by top-band operators. Stations in the US and Canada are asked not to transmit in this 5-kHz segment of the band.

DISQUALIFICATION:
If contestant omits any required entry form, operates in excess of the legal power authorized for his/her given area, manipulates operating times to achieve a score advantage, or fails to omit duplicate contacts which may reduce the overall score more than 2%, disqualification may result.

AWARDS:
Contest awards will be issued in each entry category in each of the continental US states, Canadian provinces/territories, and each DX country. A minimum of 5 hours and 50 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:
To obtain information, entry forms, or to submit a contest entry, forward a ***self-addressed stamped envelope*** to:

160-Meter Phone Contest
Dan Murphy WA2GZB
Post Office Box 195
Andover NJ 07821 USA

be sent directly to the 160 Contest Director, Don McClenon N4IN, 3075 Florida Avenue, Melbourne FL 32901 USA. Alternatively, they can be sent to *CQ*, 160-Meter Contest, 76 North Broadway, Hicksville NY 11801 USA.

TRIPLE CROWNS OF QRP

This is a new award, instituted in 1982 by the QRP Amateur Radio Club International (QRP ARCI). The triple crowns are three trophies for the leading scores in the three categories of the club's annual spring and fall QSO parties, which are open to members and non-members alike. Special certificates will go to the runners-up as well.

The engraved trophies will be awarded the QRP operators whose combined scores from the spring SSB QSO party and the fall CW competition top those of other entrants. Trophies will be awarded in these categories: (1) The top US or Canadian QRP station, (2) the leading non-W/VE QRP station, and (3) the front-running Novice or Technician QRP station (based on results of the fall CW contest only).

To be eligible for one of the triple crowns, operators must enter both QSO parties (except Novices and Technicians) because the awards will be based on their combined scores. Winners will be announced in the January, 1983, issue of *QRP Quarterly*, the club publication, which also will publish worldwide results.

The Triple Crowns of QRP will be awarded in addition to the awards issued for individual performances in the fall and spring QSO parties, whose dates will be announced later.

Those contests will continue to cite first and second place overall and top winners from each state, province, and country.

SECOND ANNUAL MICHIGAN QRP CLUB CW CONTEST

Starts: 1500Z January 16
Ends: 1500Z January 17

A CW-only, all bands, 160-to-10-meter QRP contest. Contest is open to all amateurs, and all are eligible for awards. Calling method: CQ CQ CQ QRP DE (your callsign).

EXCHANGE:

RST, QSO number, and power output.

SCORING:

Each station will be competing within its own state (W), province (VE), or country in one of the three categories: (1) one Watt or less of output power; (2) five Watts or less of output power; and (3) over five Watts of ouput power.

Each contact is worth one (1) QSO point. Multiply total QSO points (all bands) by the number of states/provinces and countries worked per band for total points. Bonus multiplier—emergency power (100% natural or 100% battery) times 1.5 of total.

AWARDS:

Certificates will be awarded to the highest scoring station in each state (W), province (VE), and country.

ENTRIES:

Log information must include: full log data with a sepa-

rate log for each band, name, address, equipment used, and power output. Logs must be received by the contest manager no later than six (6) weeks after the end of the contest. (W) and (VE) please send an SASE, and all others please send two IRCs if contest results are desired. Send all logs to: Contest Manager, Michigan QRP Club, 281 Crescent Drive, Portland MI 48875.

FIFTH ANNUAL INTERNATIONAL SSTV CONTEST
1500 to 2300 GMT March 13
1500 to 2400 GMT March 14

The contest is sponsored by *73 Magazine*, R. Brooks Kendall W1JKF, and Dave Ingram K4TWJ. It is always held on the second full weekend of March. All amateur bands between 3.5 and 29.7 MHz may be used.

EXCHANGE:

Exchange of pictures should include callsign, RST report, and contest number. FCC rules require verbal exchange of callsigns of US stations. Do not include contact number.

SCORING:

One point for each station worked. A station may be worked once on each band for credit. 1 point for each state or province worked. 5 points for each country worked, but only once for 5 points. 5 points for each continent worked, but only once for 5 points. Total score is the sum of all the credits. Excessive discrepancies in the contest entry may cause disqualification. Entries become the property of the contest committee. The decisions of the contest committee are final.

ENTRIES:

Activity sheets should show station worked, state or province, country, and band (80, 40, 20, 15, 10). Summary sheets should show number of stations worked, number of states or provinces worked, number of countries worked, number of continents worked, and total score. Contest entries should be postmarked no later than April 30, 1982. Top scorer will be awarded a certificate and a year's subscription to *73 Magazine*. Certificates also will be awarded to the top scorer for the most countries worked, and also for the most continents worked.

Send entries to either R. Brooks Kendall W1JKF, 10 Stocker Street, Saugus MA 01906, or David Ingram K4TWJ, Eastwood Village, No. 1201 South, Rt. 11, Box 499, Birmingham AL 35210.

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

THE YEAR IN REVIEW

Here's for 1981! Now *that* was a year. Remember the great songs we listened to on 2 meters? How about those wonderful movies we watched on our MDS downconverters? I don't know about you, but I feel very nostalgic about that year. It seems, as the old saying goes, like it was only yesterday.

Obviously, ham radio had its usual happenings in 1981. The customary array of scandals, court actions, FCC denials, and net jammers—all in the name of international brotherhood, of course. So, with a flutter in our voice and a crack in our heart, let's relive 1981 all over again. A year of destiny!

ELEMENT 1—CROSSWORD PUZZLE (Illustration 1)

Across

1) 1981 FCC bombshell proposal (2 words)
7) What the FCC proposes to call our service
8) K2AGZ
9) Synonym for frequency hogs
11) Popular Soviet DXpedition prefix during 1981
14) What the FCC said to expanded 160-meter privileges in 1981
16) ______ do you do it?
18) 1981: a weak year for many ham dealers to ______ rigs
19) A 2-meter rig (abbr.)
20) Not CW, not RTTY, not Fax, not SSTV . . .
21) Number of bands covered by a monobander
22) Computer ______chart
24) "Knights of Malta": now ______ DXCC
25) Nobility or DXCC running total
26) Spain
27) Interrupted code (abbr.)
28) What a contest should be
30) Propaganda station (abbr.)
32) Ham radio legend
33) What you did at your club's picnic last summer
34) Proposals for this new spot were firmed up during 1981 (2 words)

Down

1) FM tone (abbr.)
2) Expression of discovery
3) Norway
4) This and a leg would buy you a new rig during 1981
5) What many hams thought 1 across was
6) "Fruit" often found on RTTY these days
8) Many hams headed here again last spring
10) He introduced a bill affecting hams in 1981
12) FCC began calling this a "siemens" in 1981
13) Amateur space program's anniversary last year
15) Electromagnetic range
17) Ham radio turns us ______
22) New 1981 FCC head honcho, big cheese, numero uno, Mr. Big, top dog
23) Austria
29) What the ARRL's directors said to raising dues
30) FCC rule (abbr.)
31) Travel plans of many DXpeditions were complicated by the firing of some of this agency's workers (abbr.)

ELEMENT 2—MULTIPLE CHOICE

1) During 1981, the FCC issued a number of amateur stations special authority to experiment with a new communications mode. This

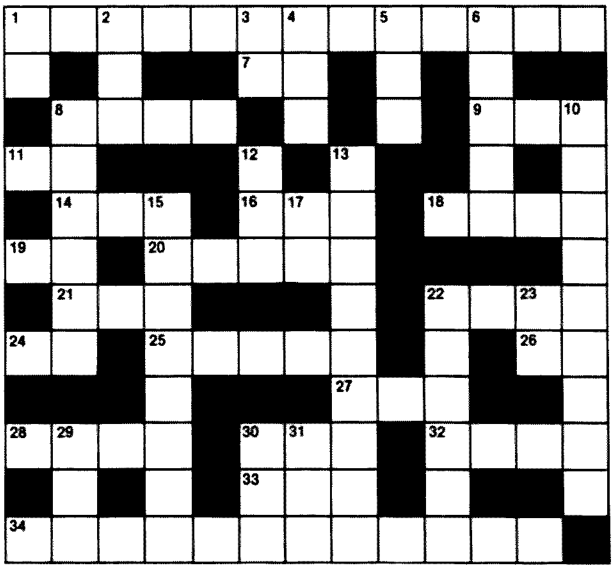


Illustration 1.

technique, which uses 10 to 100 times the bandwidth of conventional modes, is known as:

1) Spread Spectrum
2) Spread Sideband
3) Spread Frequency
4) Packet Radio

2) According to the FCC, John W. Munson, Jr., K6EOA, was sentenced to 3 years probation, fined $500, and ordered to undergo psychotherapy for saying the following over the air:

1) "Is this frequency in use?"
2) "I would love to shoot me a couple of Feds."
3) "Help, help! My boat is sinking!"
4) "Five-nine, Cal."

3) It's been a rough year for the ARRL Central Division. First, their director is "fired," next, the recall balloting of his successor gets fouled up. Exactly what problem afflicted the recall election?

1) Ballots went to members of the Hudson Division.
2) The League forgot to enclose ballots in many of the envelopes they sent out.
3) Ballots were mailed with insufficient postage.
4) The ballots got lost at the bureau.

4) OSCAR 9, launched on October 6, 1981, was built by hams from what country?

1) United States
2) Great Britain
3) Japan
4) West Germany

5) Another ARRL scandal had something to do with QSL cards. What happened?

1) A bunch of 6-land hams submitted phony pasteboards for DXCC credit.
2) The League lost thousands of WAS QSLs when they were accidentally dumped in a paper shredder.
3) The ARRL announced that after July 1, 1981, they would no longer return OSLs submitted for DXCC awards.
4) A League vice director was caught sending in forged QSLs for WAC.

ELEMENT 3—MATCHING

Even with a collapsing economy, manufacturers in 1981 brought out the usual array of new ham stuff. Here, match the product to its maker.

Column A		Column B	
1) ST-7/T	6) 100	A) Heathkit	F) TriggerTronix
2) IC-3AT	7) S-4	B) Yaesu	G) Hal
3) FT-ONE	8) MBA Reader	C) Santec	H) Bearcat
4) CT2100	9) Micro-RTTY	D) Tempo	I) Kenwood
5) TR-2500	10) μMatic	E) Icom	J) AEA
			K) Kantronics

ELEMENT 4—TRUE-FALSE

	True	False
1) In 1981, the FCC eased amateur ID rules.	______	______
2) The FCC began the practice of issuing special event callsigns again last year.	______	______
3) The FCC took action, in 1981, to take away our band at 1215 MHz.	______	______
4) OSCAR 9 has on-board SSTV capability.	______	______
5) The first US packet repeater became operational during 1981.	______	______
6) Last year, many African countries began pushing for the creation of a fourth ITU region.	______	______
7) In last year's FUN! poll, 14% of the participants admitted to jamming other stations.	______	______
8) Bo Derek became a Novice in 1981.	______	______
9) An FCC 1981 working paper proposed, in part, establishment of a code-free VHF ham ticket, amateur privileges on some CB segments, and an expansion of Technician privileges.	______	______
10) The technical breakthrough of 1981 was the development of a 3-element, top-performance, triband beam that could fit in your pocket.	______	______

ELEMENT 5—CRYPTIC PUZZLE

By using a standard substitution code, decipher this message: MH PYY MYCQKH CXMC MPPVYCVB KNW XKUUL QH MH QHBQWVYC FML FMO CXV VDQJQHMCQKH KP CXV PQWOC-YDMOO WMBQKCVDVSXKHV DQYVHOV

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1—1 Better save up for that new "spectrum spreader."
2—2 And they took away his ham ticket, too!
3—2 The problems never cease.
4—2 Gee, a G-sat.
5—1 Ever wonder why anybody would even *want* to cheat for a DXCC?

Element 3:
1—C, 2—E, 3—B, 4—G, 5—I, 6—H, 7—D, 8—J, 9—K, 10—A.

Element 4:
1—True. Now IDing is strictly a one-way street.
2—False. Well. . . I can dream, can't I?
3—True. In accordance with WARC wishes.
4—True. Stand outside and wave as it passes.
5—True. KA6M/6 is San Francisco's "digipeater."
6—True. Four's company. . .
7—True. Amazing, no?
8—False. The line of Elmer volunteers forms on the right.
9—True. The line to comment also forms on the right.
10—False. And I've also got a bridge in Brooklyn you may be interested in.

Element 5:
Coded as follows:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
M	U	Y	B	V	P	A	X	Q	Z	I	D	J	H	K	S	R	W	O	C	N	E

W	X	Y	Z
F	T	L	G

AN FCC ACTION THAT AFFECTED OUR HOBBY IN AN INDIRECT WAY WAS THE ELIMINATION OF THE FIRST-CLASS RADIOTELEPHONE LICENSE

SCORING

Element 1:
Twenty points for the completed puzzle, or ½ point for each question correctly answered.

Element 2:
Four points for each correct answer.

Element 3:
Two points per match.

Element 4:
Two points for each correct answer.

Element 5:
Twenty points for the completed puzzle.

P	L	A	I	N	L	A	N	G	U	A	G	E
L		H			A	R		A		P		
	D	A	V	E		M		G		P	I	G
Y	A				M		T			L		O
	Y	E	S		H	O	W		S	E	L	L
H	T		P	H	O	N	E					D
	O	N	E				N		F	L	O	W
I	N		C	O	U	N	T		O		E	A
			T				I	C	W			T
F	A	I	R		R	F	E		L	O	R	E
	Y		U		E	A	T		E			R
T	E	N	M	E	G	A	H	E	R	T	Z	

Illustration 1A.

How well did you remember '81?

1-20 points—Comatose during 1981
21-40 points—"It's kinda fuzzy"
41-60 points—"I remember it well"
61-80 points—"Like it was yesterday"
81-100+ points—Perfect recall

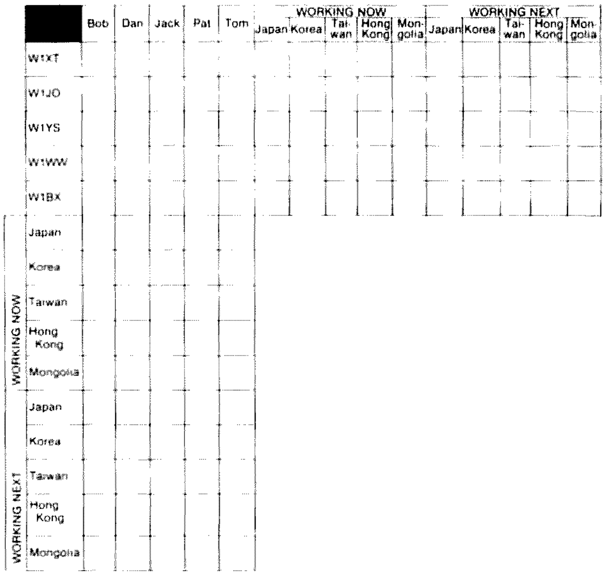
READER'S CORNER

Do you have ham-related puzzles you would like to share with FUN's readers? Then send them in for a chance to see your name in print. This month's contribution is by Bob Young W1MXI, of Belmont, Massachusetts.

Five hams set up a schedule with five DX stations.They agreed to use five different frequencies, and it was also agreed that the five hams would work the DX stations in a prearranged sequence. From the following clues, determine each ham's call, the DX station each is now working, and the DX station to be worked next. (*Ed. Note:* Names and callsigns do not represent any living amateurs.)

A) The rotation sequence is the same for each ham.
B) Bob, who is not W1XT, will work Mongolia next.
C) W1JO will not work Hong Kong next.
D) Tom, W1XT, the ham now working Mongolia, and the ham who will next work Taiwan are four of the five hams.
E) Jack, who previously worked Taiwan, will not next work Hong Kong.
F) Pat is neither W1WW or W1JO, nor is she now working Hong Kong.
G) One of the hams is Dan, whose call is W1YS.
H) Tom is not W1WW.
I) The ham who will next work Korea is not now working Hong Kong.
J) W1BX will not be working Hong Kong next.
K) Jack is not now working Mongolia.

Send in your answers. We'll print the name and call of everyone who solves this puzzle.



CORRECTIONS

IC-2 owners who attempt the MARS modification described on page 113 of the October, 1981, issue of *73* may not find a *brown* jumper on the underside of the MHz thumbwheel switch. Another color of wire may have been used. Avoid any brown jumper that is not located on the switch.

Tim Daniel N8RK
***73 Magazine* Staff**

In building the "Lab-Quality High I Supply" that appeared in your March and April, 1980, issues, I have encountered several problems that, as far as I know, were never mentioned in your corrections column. The problem is in the current-limiting circuit and its connection to the rest of the supply.

Pin 7 of IC2 will go low when the current falls *below* the set level, not above it as the article states, Also, when pin 7 goes low it will pull pin 2 low, causing an *increase* in output instead of a decrease. This results in the pass transistors running wide open when the current falls below the set level and regulation to the set voltage when excessive current is drawn.

I solved the problem by switching the connections 16 and P on the edge connector and connecting the anode of D3 to pin 3 of IC2 instead of pin 2. A simpler solution that should work is to reverse D3.

The supply works fine now and I have been running my HF rig with it. Thanks for the good construction article. I think *73* is one of the best magazines available for good construction and theory articles for those of us who like to home-brew our equipment.

Jim Skinner AC7C
1032 5th Street
Bremerton WA 98310

Reader Jim Skinner AC7C (this is a call?) has made some good points on the article, "Build This Lab-Quality Hi I Supply," as featured in the March and April, 1980, issues of 73 *Magazine. Of all the projects I have had published in* 73*, this one has shown the most interest. To date I have received over 44 queries on it, a record. Most all of the letters concerned substitutions of the power transistors with house-numbered devices. A few others concerned the design itself. One reader queried about the overcurrent shut-down circuitry. From what I have been able to discover, this reader (and Jim) have the inputs of the op amp comparator reversed. That will cause the problem he mentioned. Let me close by saying that I am delighted with the interest readers have shown in the project; it surpassed anything I could have imagined back in 1976 when it was designed.*

Gary McClellan
La Habra CA

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 10

the gap. Setting up a RTTY machine and a couple of CW stations is not going to make it. I've seen so many ham attempts at showing off at malls and fairs, but with nothing to draw in the people. This is show business, too. . . and you have to get 'em in with something dynamic. A couple of rigs and operators, sitting behind a table, is not show business.

Okay. . . now *you* write the articles and tell us how to get things moving.

FRUIT BASKET LEAKS

His Majesty King Hussein (JY1) paid our country a visit recently. After some heavy-duty meetings in Washington, Hussein headed out to Los Angeles. He must not read our Looking West column. At any rate, the L.A. hams got all excited when Hussein called in on the Henry repeater and began working the lists of stations anxious to say hello. Wonder of wonders, particularly for that area, everyone behaved. . . probably for the first time in several years. The whole group was proud as hell of their ability to cope with royalty and put on a good show.

Frank W6AOA got things set up to do a 20-meter-to-two-meter relay from Jordan that night when His Majesty returned from a dinner engagement. The gang had everything set, waiting for the big moment. Sure enough, a bit late but still game, Hussein arrived back at the hotel and checked into the repeater. At that moment, to the utter dismay of everyone, someone got on and let loose with the four-letter words, reading the king off. That certainly was the time for someone to have a finger on the repeater controls. . . but no one did and Hussein checked out immediately, remarking that he really didn't need that. Everyone felt absolutely terrible about it and you can be sure that there are going to be some major efforts at comparing voice prints of every active station in the area.

On the other hand, considering the way things have been going in L.A., I don't think anyone was really surprised. It has gotten so normal to get on the repeaters and jam them with obscenities that few blink an eye when it happens. Fortunately, that phenomenon is pretty much restricted to Los Angeles. I check in on the repeaters as I travel and I don't hear anything like that anywhere else in the entire world.

Your Majesty, if you happen to read this, I'd like to apologize for all of the good guys. . . and they are in the great majority.

SYNERGISM

If you're not familiar with the term, it has to do with two or more things which, when mixed together, provide more than the sum of the parts. In the case of radio, we have just such a result when we mix in computers. Only a few people have yet grasped the magnitude of the computer/communications mix which is coming up.

You see, as computer prices come down, a result of the economies provided by microcomputers and mass-production efficiencies, they are going to proliferate. But computers are the key to faster, lower cost, and more accurate communications, so our needs for communications facilities are going to grow along with the growth of computers. This, obviously, provides a challenge for amateurs.

Computers already are sneaking into amateur radio via the many keyboards which are being bought for both CW and RTTY communications. Fellows, you haven't seen *anything* yet. ASCII communications is just barely getting started, having been held back for years by the FCC's insistence that amateurs transmit no signals that all of their monitoring stations could not decipher. The monitoring stations, being about twenty years behind radio technology, forced amateurs to be the same.

It is going to take a prodigious communications capability to allow everyone in business to communicate with anyone else via computer. . . instantly. We're going to need efficient high-speed systems and whole new modes of communications. This is where radio amateurs can come in. . . and will, if I have my way about it.

Being the publisher of a growing number of computer magazines, I have to stay on top of the technical developments as well as the sales and uses of these systems. It may be a bit frightening to old-timer hams to contemplate a new generation of hams who are into 26,000 word-per-minute-digital communications, but that is exactly what is ahead of us. . . no matter how much we set our heels in to fight it. The day of CW is, at long last, going to fade away. As much fun as CW may be, it is a remnant of the old spark days and inexcusably inefficient. Will we set up some 50-kHz-wide CW bands in the future for old-timers to get on and bat their slow messages out? Probably.

Sure, it's fun to get on CW and make slow contacts with people. But how much is involved other than fun? We are using a very valuable resource, the radio spectrum, and since there isn't enough there for everybody, one of these days we are going to have to bow to the facts of life: You have to pay your way. There is no free lunch. . . at least not forever. To the extent that amateurs can provide services, we will be able to share in the resources, such as the radio spectrum.

Right now we do provide emergency services. We are living on past glories when it comes to providing trained people for wartime use. . . we're just too far out of date with our CW and phone communications. We're in the past when it comes to providing new inventions and pioneering them. It's been over ten years since we've come up with anything of serious benefit to the world. . . such as FM and repeaters. I wouldn't claim a lot of benefit to the world when it comes to international goodwill, either. Perhaps the FCC was right when they proposed getting rid of the list of reasons for amateur radio to exist in their rewrite of our rules.

One way or another, we either have to bring amateur radio into the 1980s, with old-timers kicking and screaming, or else we are going to have to watch over the demise of our hobby. We really do have to pay our freight.

With the worlds of communications and computers coming together, we have an opportunity to be heros again. The more we can invent and pioneer high-speed communications systems built around the needs for computer communications, the more valuable we will be. The more that American amateurs can do this, the stronger will be the American technology. . . and American industry. Don't you really get a little sick of seeing virtually every major step ahead in technology coming from Japan?

Amateurs can again be the elite of our electronics people. The ball will be carried by the youngsters we get into the hobby. The rest of us can cheer them on, help them with experiments, and try not to screw things up any more than is accidental. If you can't carry the flag, at least don't shoot the kid who *is* carrying it for you.

GREEDY GREEN?

In 1960, due to the low interest in building by amateurs, there were very few construction articles in either *QST* or *CQ*. I started *73* feeling that if I published enough construction projects I could get amateurs into building again. I obviously would have done better with the magazine if I had catered to what the mainstream of amateurs wanted. . . gossip and new product reviews.

Sideband had just recently been invented by amateurs, so I ran every article I could on sideband. . . how to build it, how to use it, and so on. Circulation, for a while, slumped as readers wrote in and protested all the sideband information. Sideband, they felt, was a flash in the pan and would soon go away, leaving their age-old AM still king. Eventually, sideband caught on and circulation slowly began to grow again.

It was about this time that I realized that solid state had a big future for amateurs. I published every article I could get amateurs to write about using transistors. Hams began to go solid state. It was a hard uphill climb, with *QST* and *CQ* fighting me every step of the way. In

1968, the technical editor of *QST* lashed out, saying that hams were tube people and that was why *QST* was not publishing transistor articles. Hams would always be tube people. . .transistors were and always would be inferior to tubes. . .a flash in the pan.

Despite the ham industry being almost totally dead, having dropped 85% in ham sales as a result of a proposal to the FCC that ham licensing be turned back to the prewar system of just two licenses, I managed to keep *73* going. We were down to a staff of five in those lean days, but still I stuck to pushing amateur radio and experimenting ahead of considerations of larger circulation.

Just as we were beginning to see the light again, I spotted FM and repeaters as the best thing since sliced bread for amateur radio. In 1969, I started going full blast on FM. I ran hundreds of articles on how to build FM rigs and repeaters, published a wide range of books, started a repeater newsletter, gave FM symposiums around the country. . .all with no help whatsoever from any other ham magazine. The readers responded with their usual enthusiasm. . ."drop dead with FM, it's a flash in the pan." Circulation dropped off as thousands of angry readers cancelled their subscriptions.

Eventually, FM became popular and things picked up again. The advertisers, ignoring the large number of FM and repeater fans in *73*, rushed to advertise their FM equipment in *QST*. . . as usual.

If I wanted to be the Mork and Mindy of ham magazines, I would flood you with articles on CW, telling you how great it is. Every poll shows that hams do not want to change the CW license exam, no matter how destructive it is. So again I am choosing the way I think we must go and I intend to push amateur radio, kicking and screaming, where it needs to go. . . both for the future of amateur radio and for the future of our country. The two, I feel, are closely entwined.

There are several factors which I see as significant as far as the future of amateur radio is concerned. One is that we are using what is still a very valuable resource. . . the radio spectrum. Thus, if we are going to pay our way, we have to provide benefits to both our country and to the world. Much of the future lies in the microwaves and satellite communications, so if we keep our ham technology twenty years behind there will be no space for us where we need it.

By keeping our amateur population down we are able to make do with communications techniques which are twenty to sixty years old and won't have to come to grips with digital electronics and modern technology. If we start growing, this will force us to invent and pioneer better systems. . . just as the overcrowded AM bands of 1960 forced the acceptance of sideband. . . over a lot of old-timer dead bodies.

Unless we take our role as an experimental group seriously, we will eventually be lumped with the CBers into one blah service. . .one which can at any time be pushed out if something more important comes along. Those of us who are using our ham bands just for fun should realize that we got them because past amateurs provided new inventions, emergency service, international goodwill, and one hell of a bunch of technicians for WWII. . . when 80% of the licensed amateurs went to war.

We earned the frequencies we are using and now there are many amateurs who feel that for some reason they have a "right" to them. Amateur bands are plain old radio frequencies and will be parcelled out for the best use that can be found for them. If we use them merely for rag chewing and DX pileups, I guarantee you we will lose out in the long run. Many amateurs really don't care whether there are any ham bands in ten years or not. They want to enjoy them . . . and curse them. . . now, and what happens later is of no consequence.

The long range survival of amateur radio lies in our providing service which is worthy of the frequencies we are using.

Pushing for the growth of amateur radio is silly from a financial point of view. Fortunately, my computer magazines are doing well and can carry *73* through the storms ahead. Perhaps you can understand why I get a bit exasperated when someone writes in and says I'm pushing for more hams in order to make more money from amateur radio.

WORKING THE PILEUPS

Down through the years of operating from relatively rare DX spots, I've tried every known method of sorting out the pileups. The problem, as I'm sure you recognize, is in getting the call letters of the stations calling. . .and it can be a rough problem when there are hundreds of stations trying to get through.

If you have a good strong signal you can sort things out much easier than when you are just barely making it through. A good system for working pileups should allow you to cope with weak signals from your station.

Hardly a day goes by that I don't hear some frustrated DX operator trying to cope with the pileups and failing miserably. His weak signals are being covered up by the stations calling him and no one can tell when he is transmitting, which leads the turkey DXers to just keep on calling, in case the chap might be listening. Some of the DXers will get mad at each other and overlap their calling so no one can ever hear the rare station.

Lists are one way around this, but they are slow and annoying to everyone involved. If one were able to find good, sharp list takers, that system might work reasonably well, with one station taking a list perhaps 10 kHz higher and another 10 kHz lower, each passing along about 20 calls at a time. This *can* work, but it isn't a good system in my experience.

It is difficult for the rare station to give the situation a lot of thought when he is facing the pileups. Most of them blunder along, not really knowing what to do. I suggest that it is a kindness, when you run into a situation like this, for an operator with a good solid signal to take a few minutes of the DX station's time and offer some suggestions on speeding up his process.

The best system I've been able to work out. . .the one which gets me the most contacts per hour. . .which, after all, is what I'm visiting the rare country for. . . is one which can be used with even weak signal strengths. It is one which allows me to work not only the louder stations but right on down to the weak mobiles on channel. It does stick to one frequency rather than spreading the callers all over the band, jamming fifty other contacts.

This system consists of laying down the rules for the callers in no uncertain terms. The rules are simple and must be followed. Any stations which break the rules will be worked, but will not get a card.

1. Stations are to call me for a period of fifteen seconds and then listen.

2. Stations are to call a maximum of three times during the fifteen seconds.

3. Stations are to give the last letter of their call phonetically and nothing else.

4. Operators are to spend their time listening and answer only when requested to.

5. Operators who try to force CW contacts without getting an okay first will not get a card.

6. QSL information will be given every few minutes, so listen, do not request it.

This system allows me to write down the last letter of ten to fifteen different stations during the calling period. I then come back and get the full call of each calling station and exchange signal reports.

When there are too many people calling at one time, I break it up by call area or by country. Sometimes it is handy, where a lot of different countries are calling, to ask for calls according to the number in the call. I've often been surprised when working the States and asking for, say, threes, to have a TF3 or an SM3 call in. . . even UK3. Of course, there are some foreign stations who refuse to understand English and will call without stopping, ignoring all requests. I sigh, work them, and mark the log for no QSL.

When you're on a DXpedition, you don't want to waste any more time than necessary, so you want your contacts to be made as quickly as possible. Also, when you are one of the pilees in a pileup, you want to waste as little of your time sitting around. . . or in yelling into the mike. . . as you can. If you'll encourage DX operators in rare spots to get on the stick and speed up their operations everyone will have more fun. And that's the name of the game. If it isn't fun, we'll stop doing it.

BUNK IN 73

The November DX column in *73* was full of the same old bunk I've been reading for some thirty

years now. Boy, I feel like I'm going through the 1920s and the emotional arguments over spark, with old-timers holding on with "spark forever" slogans.

I see the same old hogwash about CW being able to get through better than phone when signals are weak. The edge used to be a big one when we were using AM. Perhaps the "CW forever" crowd has not noticed that amateurs have invented sideband.

Another old-time rationalization has to do with CW rigs being cheaper than those for sideband. Yeah? The Heath HW-32 put that one away. How many CW-only rigs do you see today? Sure, a CW rig is easier to build, but where are they home-building rigs these days? Don't try to tell me about the poor amateurs in third world countries... they're not on the air because their dictators don't want them on the air, not because equipment is hard to build. Except in the larger countries, it is the wealthier people who are on the air.

Calling all phone ops the equivalent of CBers is baloney... emotional slop.

CW is increasing in use these days because of the digital-electronics systems developed which generate and decipher Morse code. If they would use the equipment with ASCII it would be much more efficient. You need FSK if you are going to combat fading, jamming, noise, and so on.

If we would help people enjoy the use of CW because it is fun and stop trying to lie about it, we'd have a lot more CW operators... and better ones. The biggest boost we can ever give CW is to stop jamming it down the throats of newcomers and using it as a skill filter to keep people from getting ham licenses. We have a technical hobby and I'd like to see entry to it gained via an honest technical exam... without the cheat books from Bash and the League.

MORE DETECTORS

The only thing that may stand between you and a speeding ticket if you happen to be transmitting in a radar trap is a detector. Many hams have been hit with this, as unfair as it is.

It is worth almost any investment to avoid having a chase car stop you, lights aflashing. And if that isn't enough, wait until you face our judicial system. You can read more about the traffic court system in the August issue of *Car and Driver*. The bottom line is that, facts aside, you lose. You will end up paying the fine, your lawyer, and additional insurance premiums. The bottom line makes the cost of the radar detector look cheap.

Our court system is not geared to dispense justice, but rather lo collect fines. It is bigger than you are. The best way to win is not to get into the clutches of the law in the first place. They really don't care how innocent you are and it won't cut any mustard with them.

If you are going to be foolish enough to transmit while you are driving, you'd better figure in another $250 for a radar detector. That will tell you when to shut up while you pass the police radar units.

You want a superheterodyne type of detector. Do not fall for any of the imaginative technical names which are similar... these do not work as well. None of them work that I have tested, and I've tested a bunch. Any of the superhets will do the job you want... whether it be the Whistler Q-1000, the Radar Intercept, the Gul, the Fox, and so on. Superhet, that's the ticket (or lack of a ticket).

So far in my tests I've found that the Cincinnati Microwave Escort is the best. Sometimes the edge is slight... but the S-meter on it is most helpful in giving me an idea of the closeness of the radar unit... and in discerning the home or business radar security systems which I pick up. The Escort is still $245 and sells by mail only. It's made by a bunch of hams in Cincinnati.

While the Escort and the superhet Fox can be easily stuck on the dashboard via some Velcro® tape, the Gul detector is a fat oval unit which is a bit more difficult to mount. Works fine. The J. R. Microwave Radar Intercept unit is flat and designed to snap on the sun visor. A mercury switch turns it on when you flip it down. It is almost as sensitive as the Escort. It wires permanently into the car, a drawback if you like to hide your $250 goodies when you park. If you are sensitive to the police seeing your detector, the Intercept is certainly up out of the way and fairly invisible. I've never had any flack about detectors... even in Connecticut, where I've driven my van with up to seven of them mounted on the visor, dash, and so on.

ARTICLES NEEDED

One of the reasons I bothered to start *73* back in 1960 was that I felt amateurs should read more articles on building things. At that time, the enthusiasm for building had dropped considerably... partly as a result of the drying up of surplus gadgets to work with, but mostly because the two ham magazines of the time, *CQ* and *QST*, were publishing so few construction projects. Indeed, that has continued pretty much unchanged to this day.

Building is *fun*. Today, with a handful of ICs we can build gadgets which were far beyond us only a couple of years ago. Today we have almost unlimited horizons for home-building of experimental gear. With the communications demands of computers, we need to develop new modes of communications and get them to work.

Those of you who *are* building and designing new equipment have a responsibility to come away from the workbench now and then and pass along what you've learned. Your enthusiasm will get more hams to building and they, in turn, will get still more hams interested. We're ready at *73* to help you get your material into good professional finished form.

Writing articles is easy. We do have an author's guide, if that will make you feel better. No charge, so the price is right. Mostly you have to remember to double-space your typing, to use a typewriter with upper and lower case (not a TT machine), leave generous margins... and get your details right. Photos are most helpful. Templates, PC-board layouts, and so on are invaluable.

It is most exciting to be a published author. You will hear about it from your friends for a long time. You'll get ego-boosting mail from all around the world. Hams will remember you on the air for a surprising length of time. And your family may show a new respect. You also get paid for the article, a little nicety which will pay for much of the project in most cases. And if you have something which looks like a commercial product, you could end up with a handsome royalty.

Send your articles to The Editor, *73 Magazine*, Peterborough NH 03458.

Clubs can help with this by getting members to bring in their new construction projects for a short show-and-tell session at meetings. This will not only encourage the chaps who are building, but it also will get more of the club members thinking in terms of giving it a try.

Building has never in history been easier. A few ICs, some perfboard, and almost anything can happen.

WARC-BAND BEACON

As a result of the 1979 World Administrative Radio Conference (WARC), three new HF bands were allocated to the Amateur Service. It will be some time before these bands are made available to US hams for general use. However, the FCC granted W4MB a license for Experimental Station KK2XJM to operate in the three new bands. Below is the operating schedule of the KK2XJM beacon during the first nine weeks of 1982. For further information, to QSL, or to establish special test schedules, contact R. P. Haviland W4MB, 2100 S. Nova Rd., Box 45, Daytona Beach FL 32019.

Date	MHz	Power (Watts)
January 7	10.140	30
January 14	24.930	3
January 21	18.108	3
January 28	18.108	3
February 4	24.930	3
February 11	24.930	3
February 18	10.140	30
February 25	18.108	30
March 4	24.930	30

Everyone has heard of the Ipanema beach at Rio de Janeiro. Our hotel was on Sao Conrado, around the corner. Here I arrived, eyes at half mast, after an all-night, red-eye flight from New York. The plan to stop at Brazil had been a sort of last-minute idea to cater to my fetish for visiting as many countries as possible... bringing me up to 99 if you count the UN building in New York... which I do. If it's good enough for the League, it's good enough for me. Not having arranged a ham license for Brazil, I was left with nothing more to do than rest up...and watch the hang gliders jump off the right-hand knob of Pico da Tijuca and then flutter back and forth for hours in the updraft coming from the ocean up the mountain.

Once rested, if a couple of short naps, a business conference, and a big dinner qualify as rest, we were back out to the airport and on our way to Johannesburg. Even in Brazil we felt the controller strike when our plane arrived from the US two hours late, bringing us into Johannesburg well after midnight. Both computer and ham friends were at the airport, despite the hour...and within minutes I was saying hello via one of the local repeaters to hams all around the city. A long plane ride may be comfortable for a deaf amputee, but the rest of us, with little leg room, kids crying, food every couple of hours, people bumping up and down the aisle, movies being shown...and so on...stagger off the plane disoriented and dazed. My first real awareness of Johannesburg was the next morning, early, when Julius ZS6AF came up to present me with a loaner Kenwood TR-2400 and charger. I opened the window curtains and was taken aback by the view. It was like Chicago or Philadelphia, not Africa and mud huts.

I'll bet you've been wondering what happened to all those old VW beetles. I found them, painted yellow, and being used as taxis in Rio. The chap on the left is trying to get his clothes straightened out after leaving the sardine-can ride, complete with baggage. In New York, when you see something like this it means the chap is being mugged.

Doug Goldman 3D6BG hasn't got a whole lot of signal from this rig, but then he is no pileup fan, so this does what he needs. It's sitting there for visiting hams to operate. Of course, it doesn't hurt if you stay at the hotel Doug has built. You won't find better food anywhere...and I can show you at least a half pound put on there as testimony. Fortunately, ham conditions were stinko so I got a chance to talk with Doug, get around the country and take some pictures...and even rest up a bit...for a change. Hamming comes first, of course ...then food...then my wife...then rest ...just like any other serious ham.

Swaziland looks like this. I'm not sure where they keep all of the African jungles, but I can tell you they don't seem to be in South Africa or Swaziland. Mostly farms in South Africa and idle land elsewhere. That's one of the motel units of Doug's Smoky Mountain Hotel on the left.

Alda Campos, at the right of Sherry, met us at the airport and drove us to our hotel. After we were partially rested she picked us up and took us to see her father's computer store...and plant, making Apple-like computers. I like the eating part of trips. That's her father on the left, Aldenor. It's a big happy family and we did a good job in this meat restaurant...all different kinds of meat. The waiter on the end is hacking off more meat. How do I manage consistently to stay 20 pounds overweight? No problem, I just enjoy meals like this one. Here Sherry and I are doing our best to keep up with endless courses. Computer people can be as nice as hams!

Wayne Green lost in Africa (heh, heh)...I could see the headlines in QST as we struggled to get our rented Cessna started. After an hour of screwing around, it got going... as did we, heading about 300 miles to Swaziland and another country for me. I tried to forget the plane by talking with my HT through the South African repeaters. As we neared Swaziland, I was assured through the Mbabane repeater that my license was in order. I checked the charts and changed from W2NSD/ZS to W2NSD/3D6.

Julius Lieberman ZS6AF, who runs the local ham store and is the importer for South Africa for Kenwood. His station is first rate So is he.

NEW PRODUCTS

TR-2500 HAND-HELD

Trio-Kenwood Communications has announced the new TR-2500, a compact 2-meter FM hand-held transceiver weighing approximately 1.2 lbs., yet including such features as LCD digital frequency display, 10-channel memory with memory scan, built-in five-year lithium memory backup, manual scan, programmable automatic band scan, built-in tunable sub-tone encoder, built-in 16-key autopatch encoder, 2.5 Watts rf output, HI/LO power-output switch, and other features. The TR-2500 comes complete with rubberized antenna with BNC connector, 400 mAh heavy-duty nicad battery pack, and ac charger.

For additional information, contact *Trio-Kenwood Communications, PO Box 7065, Compton CA 90224.*

LEADER LDM-855 DMM

Leader Instruments Corporation, of Hauppauge, New York, now offers a 3½-digit digital multimeter that fills the need for both laboratory and field work. The new LDM-855 offers automatic ranging, semi-automatic zeroing, and a large LCD display for straightforward, hands-free operation. When manual range or function selection controls have been changed, a momentary audible tone is heard. When used in the resistance mode or for checking continuity, the tone is sounded continuously when short-circuit conditions occur. This enables the operator to make tests without having to constantly look at the meter to see if continuity is present.

Other features include an automatic polarity indicator, ac and dc measurement functions, a LO-OHM mode to provide a lower test voltage, and a low-battery warning incorporated into the liquid crystal display.

Dc voltage range is 0.1 mV to 1000 volts with an accuracy of ±0.5% of reading ±0.2% full scale on the 0.2-to-200-volt range. On the 1000-volt range, accuracy is 10 megohms, overload protection is 1000 V dc and ac peak.

Ac voltage range is 1 mV to 1000 volts. Accuracy for the 2-V range is ±1% reading ±0.4% full scale at 40 to 500 Hz. At 0.5 to 1.0 kHz, accuracy is ±1.5% reading ±0.4% full scale. On the 20- and 200-volt ranges, accuracy is ±1% of reading ±0.25% full scale for 40 to 500 Hz, and ±1% of reading ±0.25% full scale for .5 to 1.0 kHz. On the 1000-volt range, accuracy measures In at ±1.5% of reading ±0.25% full scale at 40 to 500 Hz. Input impedance is 10 megohms and overload protection is 1000 V rms.

Ac and dc current ranges are offered from 10 microamperes to 200 milliamperes. Resistance measurements are offered between 0.1 Ohm to 2000 kilohms. The display is a 3/8-inch, seven-segment liquid crystal with a maximum of 1999 maximum. Reverse polarity is indicated, as is over-range and low battery. Primary power requirement is two C-cells. The LDM-855 measures 6-1/8 inches wide, 2-1/4 inches high, and 4-7/8 inches deep. The unit weighs 1.1 lbs. It comes complete with instructions manual, a test lead set, and two C-cells.

For additional information, contact *Leader Instruments Corp., 380 Oser Avenue, Happauge NY 11788.* Reader Service number 487.

LOW-COST ETCHING SYSTEM

Stellmaker Enterprises has designed a high-quality power etching system that is reasonably priced. The kit includes an air pump, air disperser, base with support for 4½-pint plastic tank with cover, mounting screws, and all necessary instructions.

This compact system will etch PC boards up to 6" × 6", which is the size featured in most magazine articles. The acid agitated by the air pump makes for fast and more even etching.

For more information, write *Stellmaker Enterprises, 250 Pequot Trail, Westerly RI 02891.* Reader Service number 485.

TRIO-KENWOOD R-600 RECEIVER

Trio-Kenwood Communications has just announced a new general-coverage communications receiver, model R-600, covering 150 kHz to 30 MHz in 30 bands. The use of PLL synthesized circuitry results in highly accurate frequency control with maximum tuning ease. The unit features an easy-to-read digital display, AM, SSB, and CW reception, built-in i-f filters, noise blanker, rf attenuator, S-meter,

The Trio-Kenwood Communications TR-2500 hand-held.

The Trio-Kenwood Communications R-600 receiver.

front-mounted speaker, and operation from power sources of 100, 120, 220, and 240 V dc, 50/60 Hz. Operation on 13.8 V dc also is possible, using the optional DCK-1 dc power cable kit.

For further information, contact *Trio-Kenwood Communications, PO Box 7065, Compton CA 90220; telephone (213)-639-9000.*

MFJ-955 VLF/MW/SWL ANTENNA TUNER

The new MFJ-955 VLF/MW/SWL preselecting antenna tuner improves reception of 10-kHz through 30-MHz signals. The MFJ-955 connects between your receiver and antenna. You can peak desired signals while rejecting interference and reduce overload, background noise, cross modulation, and intermodulation. Front-panel switching allows push-button selection of two antennas and two receivers, and a front-tuning knob permits tuning for maximum signal strength. The MFJ-955 measures 5-1/2" × 2" × 3" and is housed in a black and eggshell-white aluminum cabinet.

For more information, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762; telephone: (800)-647-1800.* Reader Service number 484.

The MFJ VLF/MW/SWL antenna tuner.

RF-670 SPEECH PROCESSOR

Daiwa has announced a compact audio speech processor that rivals the performance of rf types at an economical price. The photocoupler design delivers a high level of processing with a minimum of distortion. Traditional audio-processor design is handicapped by circuitry time constants that limit the ability of the processor to respond to rapid variations in the level of the input audio signal. The result is distortion and poorer performance. The RF-670's photocoupler/variable-gain amplifier design permits a very rapid response to input levels resulting in clean output. The RF-670 features Velcro® pads for easy mobile or base mounting.

For more information, contact *MCM Communications, 858 E. Congress Park Drive, Centerville OH 45459.* Reader Service number 482.

SURGE SHUNT

The R. L. Drake Company has announced its new model 1549 surge shunt. The surge shunt protects solid-state communications equipment from damage caused by voltage transients entering the antenna system. These transients usually are caused by atmospheric static discharges or nearby lightning strikes.

The surge shunt can be used with both receivers and transceivers with up to 200 Watts output. Convenient UHF-type coaxial connections are used, permitting use into the UHF range.

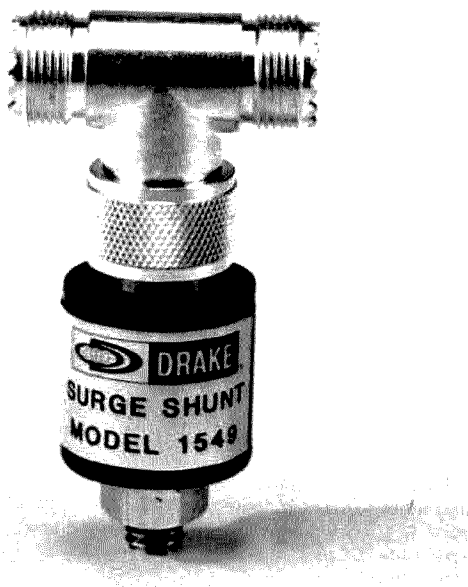
For more information, contact the *R. L. Drake Company, 540 Richard Street, Miamisburg OH 45342; telephone (513)-866-2421.*

MICROCRAFT CODE*STAR CODE READER

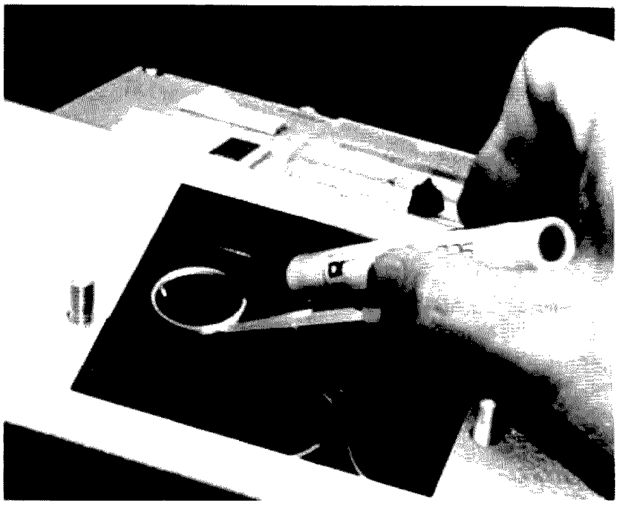
CODE*STAR is a code reader designed for Novices, SWLs, and veteran amateur radio operators. It should also be very useful to persons learning or trying to improve their Morse code skills.

CODE*STAR's microcomputer monitors the incoming signal and converts it to characters on its large easy-to-read LEDs. CODE*STAR decodes Morse

Daiwa's RF-670 speech processor.



Drake's new 1549 surge shunt.



The Desco flashlight/mirror combination.

code, Baudot (RTTY), and ASCII code. There are two specially optimized Morse code ranges with auto-tracking of speed from 3 to 70 wpm. Special proprietary analog and digital filter methods are employed to substantially reduce errors. An automatic gain control circuit providing up to 16 dB gain helps maintain signals under fading conditions. A built-in code-practice oscillator is handy for code practice and learning the code.

CODE*STAR operates on 12 V dc, which makes it ideal for field or mobile applications. An ac adapter is included if you wish to operate it from 120 V ac. As a special option, you can use CODE*STAR to drive a serial or parallel ASCII printer, TV terminal, or computer. This ASCII output port option is available as a kit that mounts inside CODE*STAR's cabinet on the PC board.

CODE*STAR is available as a complete kit or factory wired and tested.

For more information, contact *Microcraft Corporation, PO Box 513, Thiensville WI 53092; (414)-241-8144.* Reader Service number 486.

FLASHLIGHT/MIRROR COMBINATION

Desco Industries, Inc., has introduced the model 227 flashlight/mirror combination. The plastic dental-type mirror clips to Desco's model 225 disposable pocket flashlight to provide an ideal combination for field or workbench. The unit comes complete and ready to use with two AAA batteries included.

For more information, contact *Desco Industries, Inc., 761 Penarth Ave., Walnut CA 91789; telephone (714)-598-2753.* Reader Service number 483.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Last month I mentioned a new FSK converter, the FSK-500 from iRL, out in Columbus, Ohio. Let's take a look at this little gem this month.

A few months back, I examined the FSK-500's big brother, the FSK-1000. This box is not really a scaled down 1000, but rather a beneficiary of things learned from the larger unit. The FSK-500 is both a RTTY demodulator and an AFSK (audio frequency shift keying) tone generator. A RTTY modem (modulator/demodulator), if you will.

A look at the receiving, demodulating, end shows quite a performer. Audio input is accepted through a standard phono jack, such jacks being used for all connections but the loop, as a 500-Ohm unbalanced signal. That means that most speaker or "line" outputs will work just fine. The amplitude of this signal may range from 10 mV to 17 *volts* peak to peak! That's some range, folks. The audio is then passed through a limiter, and selectable bandpass filters are available to optimize reception for either "narrow," with a bandpass of 75 Hz and low-pass filter rolloff of 28 Hz, or "wide," with a bandpass of 145 Hz and a rolloff of 60 Hz. The narrow filter is normally used for 170-Hz shift RTTY; the wide position is useful for 850-Hz shift, as commonly used on AFSK, and ASCII transmissions.

Three selectable shifts are also provided. Along with the common 850-Hz and 170-Hz shift, a 425-Hz shift is available. This is useful for copying commercial stations and other non-ham signals. By the way, the shift is selectable independently from the bandwidth, so odd combinations can be easily set up.

Internal mark-hold circuitry and autostart are provided, and the level at which a signal begins to be decoded is adjustable by the front panel "threshold" control. The general function is kind of like a RTTY-squelch control, serving to keep the machine quiet when no one is transmitting.

Tuning is aided by both a meter which shows a mid-scale deflection for mark and a full scale deflection for space, and by LEDs which display the mark or space status of the loop.

Outputs from the FSK-500 include an RS-232 compatible output, called "Data Out," which is useful for driving a video terminal or computer. Of course, interfacing to a standard RTTY loop is provided, but, and this is notable, an internal loop supply is *not* provided. That means you have to supply the 60 mA current from another source. This is not too hard, and we will cover that in a little bit.

As if that was not enough, a "Serial In" jack accepts either "dry" contacts, such as a reed relay or isolated keyboard, or RS-232 levels. This allows a computer to key the transmitter and loop. There is also a provision made for connecting a straight key for the mandatory CW identification.

Remember I called this thing a "RTTY modem"? Well, here is the "mod" part. A built-in AFSK generator provides a low impedance, clean, 50-mV audio frequency shift signal. This can either key a VHF transmitter or AFSK, or, when fed to an SSB transmitter as detailed previously, result in a nice, clean FSK signal.

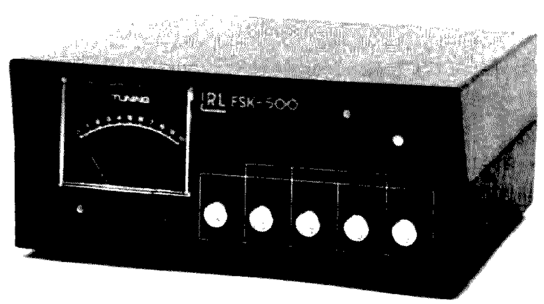
A few more bells and whistles include a transmit/receive remote function and an output able to key the push-to-talk line of most transmitters. Scope outputs are also provided for those of us who like to monitor the RTTY signal on such beasties.

Now, the acid test is not what it looks like on paper or how pretty the case is, although you can see that for yourself in the photo, but how well it performs on the air. I also like to compare new equipment to older units to see if we have gained anything. So what I did was to find a reasonably clear, but not solid, RTTY signal and sit my wife down in front of the revelver and ask her to tune it in. For comparison, I set up my several-year-old ST-6 and asked her to comment on the two.

Allow me to interject that my wife knows about as much about RTTY as most hams know about cooking blintzes. If she could do it, anyone could!

Well, she could, and despite similar tuning indicators on both demodulators, i.e., two lights and a meter, the FSK-500 appeared easier to tune. Now, I don't know if the filters in the ST-6 are more critical than the FSK-500, but I suspect that that is so. However, when we went looking for signals, there was not one that the ST-6 could copy that the FSK-500 could not do as well on. Very impressive.

All in all, the FSK-500 is a very nice little box. For under $250, in a box 7.75 inches wide, 3.25 inches high, and 7.375 inches deep (that does not even fill the size of this page!), you can get a demodulator that may well be all you need on RTTY, Murray, or ASCII for a long time. Check out iRL's advertisement here in *73* or drop them a line at 700 Taylor Road, Columbus, Ohio



The FSK-500 from iRL.

43230. Be sure to tell them you read about the FSK-500 here in RTTY Loop.

Oh yes, about that loop supply. One of the only sacrifices apparent in the design of the FSK-500 is the loop supply. Of course, if you are running a computer-based station, you have no need for a current loop. If that is the case, turn the page and drool over the ads; otherwise, hang in here for a spell. Common teleprinters, such as the Model 15 Teletype®, use a current loop, usually about 150 V dc to 300 V dc, at a constant 60-mA current. It is not hard to design such a supply, and it makes a good construction project for the RTTY-neophyte.

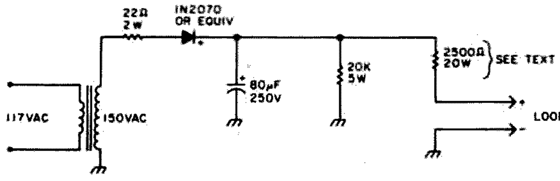


Fig. 1. A local loop supply.

If you have a dc supply (we will worry about where the dc comes from later) providing, let's say, 180 V dc and you hook it up to the selector magnets of your teleprinter, what would happen? After the smoke cleared, you would have a worthless hunk of junk. Why? Remember that the resistance of the selector magnets is in the range of 100 Ohms. If 100 Ohms is placed across a 180-volt source, thinking back to Ohm's Law, it will draw (I = E/R) 180/100 equals 1.8 Amps! That would produce about 324 Watts of energy. Think that's enough to fry the coils? I do. In order to limit the current to 60 mA, you have to provide enough resistance in the circuit. In our example, it would be (R = E/I) 180 volts divided by 60 mA (0.06 Amps) equals 3000 Ohms. So a 3000-Ohm resistor at, don't forget this, 180 volts times 60 mA equals a tad more than 10 watts—let's make it a 15-Watt resistor or higher to play safe—is needed.

In practice, you have to account for a variety of resistances; thus an adjustable series resistor is commonly used. A practical circuit is shown in Fig. 1. By the way, *don't* get any bright ideas about eliminating the transformer and just rectifying the ac into loop current. We don't need any hot teleprinter chassis around.

KAHANER REPORT

Larry Kahaner WB2NEL
PO Box 39103
Washington DC 20016

DIRECT BROADCAST SATELLITES: A LONG WAY TO TRAVEL

The fate of Direct Broadcast Satellites is up in the air.

Unlike low-powered satellites similar to SATCOM 1 and 2, which are mainly used to relay TV programming to cable companies owning big dishes, high-powered DBS birds aim their beams directly at smaller-dished consumers. Plans call for viewers to rent or purchase receiving gear and dishes (less than a meter in diameter) and for satellites (more than 200 Watts) to reach homes in as much as one-half of the country at the same time.

Some DBS hopefuls plan subscription TV services—in which case you must buy or rent their decoder—but others suggest that advertiser-supported programming is the way to fly. Still others say that regular video programming isn't enough to woo the public. They plan high-resolution TV and data banks for home computer hobbyists.

Although the DBS dream has been around for some time, only in the past few months has the FCC tackled the complex policy and technology issue involved in such systems. Last July, they decided to okay DBS on an interim basis pending further discussion. They also agreed to tentatively accept more than half a dozen license applications. However, no DBS applicants expect to begin full operation for another 2 to 5 years.

Some technological hurdles need to be jumped. For instance, DBS uplink frequencies are in the 17-GHz range, and downlink frequencies lie in the 12-GHz band. At those frequencies, engineers worry about attenuation from rain and fog. It seems that the higher the microwave frequency, the less you can sing in the rain.

Interference to fixed services presents another problem. Some point-to-point microwave services already use those frequencies and what effect DBS will have on their transmission (and what effect they will have on DBS) must still be explored.

However, the biggest "if" in DBS may be economic. Many figures are being bantered about, anywhere from $200 million to $800 million for a typical DBS system. If companies charge about $25 a month for the service (that's the maximum experts suggest viewers would be willing to shell out for any pay TV service), can a DBSer break even? Will consumers pay extra money for only a few additional channels when they already receive 20 or 30 on cable TV? Or would a DBS operator do better with advertising support?

The Space Shuttle might help some aspects of DBS. The most expensive part of hurling a satellite into orbit is the launch. Several DBS applicants noted that once the Shuttle is regularly whizzing back and forth in the coming years, DBS launch cost will be greatly decreased.

COMSAT checked in as the first DBS applicant, asking the Commission for permission almost a year ago to run its service. In a 1,000-page application, COMSAT'S subsidiary, Satellite Television Corporation, said it plans 3 commercial-free channels. Channel A (Superstar) will feature general entertainment such as films, concerts, and family programming. Channel B (Spectrum) will show children's programs, film classics, and public affairs. Channel C (Viewer's Choice) will offer sports, adult education, and experimental theater.

STC plans to serve the entire US with 4 geostationary satellites—one in each time zone—with spot beams aimed at Hawaii and Alaska. Each bird will carry 3 operational transponders and 3 spares. Liftoff for the first DBS satellite is slated for 1985. It would serve the east coast.

COMSAT and Sears-Roebuck planned to work together on DBS, but Sears pulled out. COMSAT is looking for a new partner but hasn't had much luck.

Another DBS entry comes from a company called Graphic Scanning Corporation. It proposes 2 satellites, each independently programmed. One satellite will target the home computer market with information relayed from the firm's information banks. Data will be sent over the video signal using

teletext, a system which compacts digital information in the vertical blanking interval of a TV's video signal. Because the home hobbyist can't talk back to the satellite and ask for information, he will have to download great quantities of data and then access what he needs and hope it's there.

GSC's other satellite offering appears mundane by comparison. It will transmit the usual TV fare including movies, sports, and concerts.

The company is serious about its application. It owns Graphnet, a computer/networking firm, and lists assets at more than $83 million.

Video Satellite Systems takes a different approach. It wants to establish an advertiser-supported DBS system with local TV stations and cable companies also receiving, then retransmitting, its programming to viewers. In a sense, it just seems to be another network, like one of the Big Three. VSS will scramble signals destined for these carriers but send unscrambled programming to those areas where consumers constitute the bulk of recipients.

VSS said its total investment will run just shy of $230 million for 4 satellites and related equipment.

Even the networks want in on DBS. CBS asked for FCC permission to operate a 3-satellite service which would send such goodies as high-resolution TV, a feed to affiliates, pay TV, and teletext. The high-resolution programming would be targeted at affiliates for rebroadcast. That assumes that we all have our hi-res TV sets by then.

Other major companies look for the go-ahead. RCA told the Commission it wants to shoot 4 satellites beyond the wild blue yonder, each carrying 6 transponders, 2 of which will sport high-resolution gear. Service will be aimed at individual homes as well as community antennas. A full system—kind of a starter service—would cost $400 million. RCA noted that DBS is economically feasible where cable services can't be provided for less than $500 per home.

The FCC received a total of 13 DBS applications. It accepted those from CBS, DBS Corporation, Graphic Scanning Corporation, RCA, Hubbard Broadcasting, Video Satellite Systems, and Western Union.

Those applicants that didn't make the FCC's grade include Advance, Inc., National Christian Network, Unitel Corporation, Satellite Development Trust, and Home Broadcast TV Partners. It partially accepted an application from Focus Broadcast Satellite, which doesn't plan its own bird but hopes to use one of the Western Union WESTAR satellites for its interim service.

Most applications weighed several pounds, contained hundreds of diagrams, charts, graphs, pictures, statistics, formulae, tables, and charts. But several consisted of only one or two typewritten pages. These, of course, were rejected by the FCC as "deficient." In other words, the DBS hopeful wasn't serious about his plan or didn't have the funds to back it up—or both. Even longer applications were rejected as deficient. Length isn't everything.

The FCC rejected applications from Home Broadcast TV Partners and Unitel for special reasons. The drafters were serving time at a federal prison near Terre Haute, Indiana.

Even if all the domestic DBS policy and technical questions are answered, international roadblocks exist. In 1983, the US will join other nations around the Regional Administrative Radio Conference table to discuss frequency allocations for microwave bands.

The FCC proposes that DBS operate in the 17- and 12-GHz range. That's fine for us, but other countries want those frequencies for their own DBS and, in some cases, for other services as well. Because we're dealing with satellites, receiving areas don't stay within neat geographical borders. DBS transmissions from abutting nations will overlap.

By the middle of the decade, about a dozen countries hope to install DBS services: Australia, Canada, China, a Consortium of European nations represented by the European Space Agency, France, Germany, Japan, Luxembourg, Switzerland, United Kingdom, the USSR, and the US.

RARC participants have a lot of talking to do.

LETTERS

ELMER: ALIVE AND WELL

Having read Tom Taorimina's letter in the November, 1981, issue, hoping for the return of Elmer, I have to admit that I agree with Wayne's response. And that ain't all that unusual.

Sure, ham radio has changed. Hell, we all have. To expect the return to the days of 6L6s, homebrew transmitters, and so forth, in this day of transmitters on a chip, is to expect better than the Second Coming.

Those moral changes that Tom said happened in the 60s: let's have them and some more. Maybe we gained a little humanity by getting off our dead ends and out of the back of the bus.

The problem is, some would have us return. Separate but equal drinking fountains. Woman at home, barefoot and pregnant. The man the undisputed ruler of the house. Child abuse. No sir, not me, Jim.

Looking back at it that way, it's obvious that Elmer isn't dead. He's alive and well, caring for humanity, like he always did. Only his areas of activity and interest have changed. Now he's into SSTV, satellite communications, cheap and easy microwave. People.

One thing's for sure about old Elmer. He doesn't sit in the sun belt and bitch about how rotten things have become. Elmer's a doer.

And he's got a million-dollar smile.

Nils R. Bull Young WB8IJN
New Carlisle OH

HAM HELP HELPED

We asked for help in your Ham Help section of *73*. Man, did we get help! In fact, we are still getting it. Really, all we asked for was a schematic or a service manual for a DSI frequency counter. Wayne, you could just not believe the response that we received from the ham fraternity when my request was published in your magazine. The response was the most impressive thing that I have ever witnessed in my 29 years of amateur radio. You may talk about the power of the press; *73 Magazine* has made a believer out of me.

I want to thank you, and all of the amateur radio fraternity who came to my rescue to help me out. In closing, I want to let you know that if I should ever need a coverage on anything related in our profession, I will most certainly rely on you and your outstanding publications.

Lawrence Neel, Jr. W8PKV
Cincinnati OH

LIP BITING

You can thank or blame your October "Never Say Die" for this letter. That editorial started with a caption which stimulated this reader to give you one old-timer's view of the other side of the coin. It happens that I have been in ham radio since 1929... have written for **CQ**, **QST**, ***Radio Electronics***, ***Popular Electronics***, and ***Electronics***...have also lectured at hamfests and an IRE convention. Like you, I witnessed and contributed to the growth and popularity of ham radio. Then, due to a new assignment and the pressure of making a living, I dropped out of the fraternity and did not return until after my retirement. Wow!

I missed the multimillion-dollar explosion that was brought about by SSB and the consequent sale of a million or so transceivers and supplementary gear by your advertisers...an era which also resulted in a many-fold increase in the cost of operating a station... an era which also imposed a severe hardship on any prospective newcomer to the hobby. Then along came CB...and that was the straw that broke the camel's back.

So you want to know what is needed to reactivate ham radio? Well...bite your lip and hold on to your temper...what we don't need is a rich man's elongated

legeo writers on now to build sophisticated and digitalized electronic equipment using lots of integrated circuit devices, which few of us comprehend. Too bad the authors and publishers don't have to stand up in front of an audience for a Q&A session... talk about red faces!

Don't go away now... the pièce de résistance is coming up. Of all the things we surely don't want, your continued writing about your activities in the computer field have to be near the top of the list. Did you ever stop to consider that such writings tend to convince us that your heart and personal interests and *ambitions are far* removed from our beloved ham radio field?

Now then, if you have indulged me this far, stick around for a few more minutes. I'm about to say something nice. Once in awhile, you publish an article which is down-to-earth and of genuine interest to a sizable percentage of us hams. Let me cite the "Diode Doctor" article which appeared on page 131 in your October issue. Too bad the editors allowed the author to make use of a 9-volt battery which had *two* positive terminals and *no* negative terminal. Sure, we inferior hams can figure out the error, but we can also figure on similar errors being in projects that take longer than "about 15 minutes" to build.

By the way, if you are getting the idea that I am an unfriendly correspondent, please refer to your July, 1981, issue, "Fun," page 140, second column, last paragraph. I am one of your staunchest boosters. Nevertheless, I believe you have drifted away from your own publication. Of course, I can only judge by my own experience, but I can't believe your people could possibly single me out for careless treatment. Like the way your Subscription Department loused up my subscription... missed sending me the first issue as specified in your advertisement... then sent me two copies of a subsequent issue rather than the one I expected to get... then kept insisting that I did not pay for my subscription until I got my cancelled check from the bank and gave them the number and date and data.

I started out 1981 by writing an article for *73* entitled "The Jim-Bug." It was promptly accepted. A check followed a few months later. But now is many months later, and I have still not received a proof for review. You must agree that is no way to make friends and encourage more articles. If they have changed their minds, why don't they say so and send the article back to me?

Well, I have now given you over three hours of my time in composing and typing this letter, but I don't want to end it on a negative tone. So I'll put forth some more effort on the subject of promoting the growth of ham radio. To do this, we first have to realize that most of the active hams, who regularly have to fight QRM for enjoyment of their hobby, do not favor additional growth. Second, we have to find ways to get prospective newcomers into the fraternity without mortgaging their homes. This means making available simplified and lower-cost equipment, home-built, kits, or manufactured. Third, we have to provide air space and regulations where such equipment can be used. Fortunately, the air space has already been made available in the new bands... bands which many of us old-timers don't want and can't use. So why not leave it up to the League? Because if we do, we are going to get more of the same SOS.

Jim Owens W5JOF

"...a station" is another tune I've heard often... but not from anyone who was there before. I ask you to recall the cheap and junky Hallicrafters Sky Buddy receiver which sold for $29.95 in 1938. Today, for about the equivalent inflation-adjusted price of that old crummy receiver, you can buy an allband receiver that will run circles around that old one. Hams have never had it so good as far as equipment prices are concerned.

I did enjoy the "rich man" bit, too. Jim, I started out with nothing and worked hard to build up my business. When I started 73, at times I didn't have enough money to eat but I hung in there and worked 100-hour weeks... and more. My recent trip to Africa cost me little... it was paid for by the people who came to hear me talk in Johannesburg. They paid to hear me because I have taken the time and interest to know my field and be worth listening to when it comes to computers... something I've managed to learn in just the last five years. And Jim, talking with foreign countries is one of the basics of amateur radio, so I've always found hams intensely interested in what is really going on in them... in particular, the rare ones.

Okay, now I'm to the bit about building sophisticated digital electronics. Our recent reader poll gave us an 82% reader vote on our articles being about right, 7% said they were too simple, and 11%, too complex. I don't think we could run the ball any closer to the center of the alley.

With computers and amateur radio coming together on a collision course, I've found that most amateurs want to know all they can about them. I asked for a show of hands at a recent ham club meeting and almost half of those present said they already had a computer. Actually, only about 20% of the active hams have a computer system so far... but that is increasing rapidly.

Jim, with about 90% of our income coming from computers, it would make just plain sense if I gave amateur radio no more than 10% of my time. But I now find myself as the chairman of an FCC subcommittee to get amateur radio into a growth mode, which will take time I could ill afford if plain making money were all that important. You may find many hams who are spending more time enjoying the benefits of amateur radio, but I wonder how many you'll find who are investing their time as much as I am, and also a few others of NIAC, in the future of our hobby?

Now, on that article. I hope a few readers look it up and explain it to you. There is nothing at all wrong with it. The battery goes between the plus and ground terminals.

The subscription department is far from perfect... but it is one of the best in the country. It is a commercial service and our complaints are a tiny fraction of what we've had in the past. They are also incredibly expensive.

Articles are bought for the purpose of publishing. It can take up to a year or more, if an article is not one of strong time value, before it is published. It'll be along.

Many old-time hams, rather than cope with new narrower band techniques, are pushing to stop ham growth instead. Some may still be around muttering "spark forever" under their breath. Jim, we will develop new modes of communications and we will grow... a lot... or we will die.

May I respectfully also point out that while it is possible to find ham bands which are packed, we also have a bunch of others where there is no crowding. Perhaps, if you could march to a slightly different drummer, you might enjoy interference-free contacts. Much of 10, 6, 2, and upward are quite open. Even 15 is seldom filled up... if ever. So why go the lemming route and insist on adding one more bit of noise to the few jammed-up frequencies?—Wayne.

MONEY GRUBBING?

I find little of interest in *73*. My interests are mainly in the technical or project end, and I find that much of this sort of thing is either not present or of no interest. Probably the most important single project these days would have to be low-voltage, high-current power supplies of up to 500 Watts. When was the last time you ran a good article on such as this? Some time ago you used to run useful articles on computer interfaces with ham radio. Then you started some computer mags and, of course, then tunneled all these

into the computer publications. But, now, lo and behold, you are a big honcho in the Instant Software market place and appear reluctant to put anything in *80 Micro* that you might be able to flog through Instant Software. Very subtle!

All that aside as a fairly typical money-grubbing ploy, frankly, your attitude to ham radio scares the pants off me. You come out in favour of people being able to buy copies of the examinations, you are against nets, you deplore the fact that anyone wants to remove the certifiably insane from the air, you want to increase the ham population of the States by some 200,000.

Take a look at the two *Callbooks* side by side. There are already more hams in the States than all the rest of the world put together. Your examinations are a joke in many parts of the world. There are probably more lids in the W4/5 district than the whole of the rest of the world. It is almost impossible to do anything organized on the air without having someone deliberately interfere. I suppose you would consider this an infringement of civil rights to restrict these activities! Now you want to get the rest of the "Criminal Band" fraternity on the air. Nice for circulation. Must make you drool!

I clawed my way up to number two on the ARRL Public Service Honor Roll until I quit in disgust when it finally dawned on me that the ARRL did not in fact represent the interests of the amateur but rather the interests of the executives and staff at Newington.

While I sometimes thought your articles on the ARRL were a bit overstated, in general I agreed. Now I am beginning to find some frightening similarities. Would success and fame go to Green's head?

A. E. M. Spence VE7DKY
Vernon BC
Canada

AEM...phooey...and I'll tell you why. There you are carping at someone who is getting things done and moving the world ahead a bit, with your contribution one of having "clawed" your way up to number two on the ARRL Public Service Honor Roll. Well, whoo de doo. Lookie here. I resent your insinuation that I'm money-grubbing. Oh, I'd like to be, but I keep thinking of more projects and whoosh, away goes the grubbed money.

I did enjoy the bit about Instant Software getting the good 80 programs. If you could hear the beefing I have laid on everyone around here, just trying to get the Instant Software people to even look at a copy of the magazines to see if any of the programs we have published might be worthwhile to distribute, you'd know what I mean. I've tried to get ISI to let the magazines take a look at their losers for possible publication. I think we are making headway there, but only recently. No, you're full of it as far as that one is concerned.

Please let me know where you got the idea I'm against nets. Having called into 'em for years, that's a new charge. Matter of fact, one of the services we're planning for the W2NSD/1 bulletin board is a net listing. And the Bash Cheatos? Well, by refusing to run ads for the Bash "guides," we're passing up perhaps $15,000 a year in advertising, so what do you want from me? I do think that his "study guides" and the ARRL Q&A Manuals have provided the cheats the easy way to get a license for as long as I can remember. My license study manuals are not that kind...they teach the theory. You're all wet again.

The Callbook? *How can you be so off base on* everything? *They don't list about 90% or more of the Japanese hams... or about 90% of the Russians...and a lot of other foreign hams. If they did, no one would buy the book...it would look like the Manhattan yellow pages...and cost a fortune.*

And you're after the CBers too. For your information, sir, about 90% of the US hams licensed in the last ten years started out on CB. Bad operating is not really new...just ask any old-timer. Spence, I was there 50 years ago, so I know what it was like then. I've been active ever since. If you want to know about deliberate interference, just read the editorials in the 1920 and 1930 issues of QST. Nothing has changed... it's just that you have no perspective and you, for some odd reason, think things were better. They weren't. The next thing you'll be beefing about is that people don't build anymore. Well they do...and more than they did 50 years ago.

Will success go to my head? Probably. I do admit to enjoying it, mostly because as a recognized success I am able to get much more done. My ideas now are able to reach people and, in view of my success, be taken seriously. Would you want to read a book on how to make a million dollars written by someone on welfare?

Power supplies? Lordy, we've published so many power supply articles in 73 that another publisher has taken them and published a book on the subject.

My interest is not to increase the ham population of the United States by 200,000...in which you are consistent in your inaccuracies...it is to lift it to 2,000,000. Why be chintzy?—Wayne.

COMBATTING RADAR

I have recently learned that the State of Wisconsin is in the act of passing a new law outlawing radar detectors. It will be a $200 fine if you are caught using a radar detector.

Does anyone out there know if the various radar detector companies are willing to go in to try to overturn this law in state court, or at least help someone who wants to? I think it is a crime if they are about to outlaw receiving *any* type of radio transmission, including radar. If anyone knows how to combat these kinds of laws, or how to go about overturning them, or if they have gone through this kind of thing already, please write Ken Slate W9ITW, 427 Hamburg Street, Ripon WI 54971.

Kenneth H. Slate, W9ITW
Ripon WI

HAM VERSUS CABLE TV

I noticed a letter in your September issue regarding CATV 2-meter interference. I was a CATV technician in charge of quality control at a large northeastern system for over six years and would like to take this opportunity to discuss this problem.

FCC rules pertaining to radiation from CATV currently state that between 54 and 216 MHz, radiation shall be not more than 20 μV/m at a distance of three meters. Above and below that frequency range, the level is 15 μV/m at 30 meters. They further state that should interference to another duly-licensed service occur, radiation must be reduced to the point where no interference occurs regardless of levels involved.

Under the present technology and methodology employed by conscientious CATV systems, it is all but impossible to locate radiation below about 14 μV/m at three meters. The problem is that the typical 144-MHz rig has a sensitivity of less than 1 μV for 10-dB quieting; near-field radiation is more an inverse linear function than inverse square, so interference is bound to occur in a metropolitan area.

From my experiences, the main trouble spot appears to be 145.25 MHz which is both CATV channel E and a repeater frequency. The following are possible solutions, in no particular order of feasibility.

1) Do not assign this frequency to a repeater.

2) The cable TV company can offset channel E by plus or minus 10 kHz. These are standard offsets. Probably a greater offset would help.

3) The cable company could use a harmonically-related carrier headend.

4) The repeater frequency could be offset. Probably 10 to 25 kHz should suffice.

5) Hams in areas not present-

ly cabled should keep informed about any CATV activity in their vicinity. Offsetting or using a harmonically-related carrier headend are decisions to be made preferably before activation of a system.

There are many hams in the technical side of CATV who can help and management types are usually pretty open-minded. With the proper attitude, maybe both sides can solve the problem once and for all.

Robert Wanderer WB2MCB
Herzliyya, Israel

Wouldn't it be great if all cable operators shared WB2CMB's open-minded, conscientious attitude? Unfortunately, many CATV companies are reluctant to upset the apple cart, much less spend any money that would result in a reduction of short-term profits.

The idea of a legitimate amateur repeater shifting its frequency to accommodate CATV does not appeal to me. It is just another form of spectrum robbery. Offsetting the cable channel and insisting on a well-shielded system should go a long way towards reducing the problem.

A firm but tactful approach seems to be in order. If the cable operator refuses to cooperate, perhaps some high-power transmissions on or about 145.25 MHz will prompt action.—Tim Daniel N8RK.

TAKE US ALONG

I want to tell you how much I enjoyed Wayne's description of the St. Lucia trip and the fine article by Jeff DeTray, "Contesting from VP5," with more Turks and Caicos adventure. Thanks for taking us along via the article and "Never Say Die." Let's have more satellite and MDS articles.

Wilbur Golson W5CD
Baton Rouge LA

DXPEDITION HELP

DXpeditions International was formed by a small group of DXers who desire to help DXpeditions to the more rare DXCC countries. In order to meet this goal, the DXpedition Fund was established and shall remain on deposit until a significant contribution can be forwarded to a deserving DXpedition. At the present time, the DXpedition Fund is small, and outside membership and participation is paramount to its success. The DXpedition Fund's assets are on deposit at the Fulton Federal Savings and Loan in Waycross, Georgia. Interest paid on this deposit is returned to the fund. As the fund grows, more assistance will be rendered to DXpeditions which otherwise may not "Make The Trip."

Individuals or clubs may request assistance for their DXpedition by writing to DX Review Committee, DXpeditions International, 999 Wildwood Road, Waycross GA 31501. This request should include the plans and details of the proposed DXpedition. A business-size SASE would also be appreciated. (As you can see, we desire to keep costs down, thus providing more assistance to a DXpedition.)

Before the DX Review Committee can make a final commitment for funds, the DXpedition organizers must meet some strict criteria. The complete list of criteria will be forwarded to those who request our assistance, but for example, they include the following:

1) The DXpedition must have in hand the licenses or permits required for operation from the proposed DXpedition location.

2) DXpedition members must have the appropriate passports, visas, and other documents required for entrance into the country or locality from which they will operate.

3) DXpedition organizers must furnish a financial statement of DXpedition funds on hand and a complete cost analysis for the DXpedition.

When the DX Review Committee rejects an application for failure to meet requirements, the applicant may reapply at such time the criteria can be met. The amount of assistance will be determined by the assets of The DXpedition Fund, the needs of the DXpedition organizers, and the rareness of the country of proposed operation.

The organizers of DXpeditions International and their families *are not eligible* to receive assistance from the DXpedition Fund, but those holding memberships in the organization, either full or limited, shall receive priority consideration when applying for assistance for their DXpeditions.

In order to keep the membership of DXpeditions International informed, a newsletter is printed on a weekly basis. This newsletter is mailed to all members and is devoted to the news and operations of DXpeditions and other DX as may be "On The Bands." Membership categories are:

1) Full Member—Receives the DXpeditions International newsletter and also makes a significant contribution to the DXpedition Fund. (US $38 fee.)

2) Limited Member—Receives the newsletter but does not make any contribution to the DXpedition Fund. (US $28 fee.)

3) Friend—Our Friends are not members of DXpeditions International but are individuals who desire to make some contribution to the DXpedition Fund. The size of the contribution varies from Friend to Friend, but the entire amount is deposited into the fund.

DXpeditions International hopes that it can make a marked contribution to the amateur radio fraternity and to DXing. With your help and participation, this goal will be met.

DXpeditions International

JERRY AND DXCC

This is the real K2RA, and unfortunately for me my K2RA call has been bootlegged on the air by some culprit named Jerry since 1978, mostly in contests and on the 20- and 10-meter SSB bands. His location is unknown.

This guy Jerry is using up all of my envelope credits at the North Jersey DX Association QSL Bureau, and that's how I found out about him. I have enough DX cards confirming his contacts made with my K2RA call for me to get DXCC! I have notified the ARRL and the FCC. Jerry can pick up most of his cards with my callsign at this address (except for the ones I sent to the FCC). I will be glad to meet him.

D. M. Rager, Jr. K2RA
Buffalo NY

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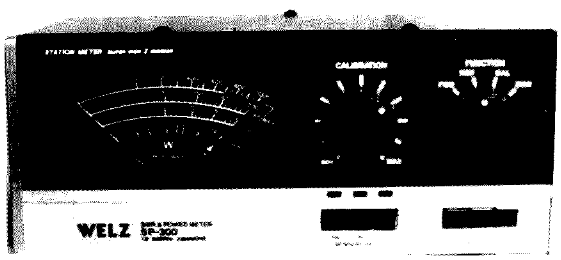

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HAM HELP

In order to repair my Hallicrafters receiver, model SX 122, I must find a schematic diagram and my problem is that I can't even find Hallicrafters in the States let alone the schematic.

A tag on the receiver shows it was made in Chicago but the Embassy here has no Chicago address. What to do? Has it gone out of business?

Any help will be greatly appreciated indeed.

Hal R. Cozzens
Managing Director
P.V.S. Enterprises Co., Ltd.
Chongkolnee Bldg., 3rd Floor
56 Suriwong Rd.
Bangkok 5 Thailand

Need manuals for Ballantine Labs model 300E or 300H; also TS-323/AU frequency meter by Hoffman Radio.

Bill O'Meara WB3LPB
807 E. Seminary Ave.
Towson MD 21204

I am looking for information and plans for a touchtone™ decoder. Can you help? Thanks.

W.R. Hudson
PO Box 400814
Dallas TX 75240

I would like to purchase manuals or schematics or copies of them for the following equipment:

1) Alfred—Microwave oscillator, model 621-B. 2) Boonton—(Hewlett-Packard) UHF Q-meter, model 280A. 3) Cimron—Digital multimeter, model 7630. 4) FXR—Power meter, model B-831A. 5) PRD—Receiver, model 915. 6) Polarad—Field intensity meter, model FIM. 7) Polarad—Microwave receiver, model "R" and/or RB-1. 8) Servo Corp. of America—Pulse-sweep generator, model S-880-CS.

Any assistance will be greatly appreciated.

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4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	7	7	7	7	7	7	7	7A	14	21	21A
ARGENTINA	14	7A	7	7	7	7	7A	14	21A	21A	21A	21
AUSTRALIA	21A	7A	7B	7B	7B	7B	7B	14	14A	21	21	21A
CANAL ZONE	14	7A	7	7	7	7	7A	14	21A	21A	21A	21
ENGLAND	7	7	7	7	7	7	14	21A	21A	14A	14	7A
HAWAII	21A	7A	7B	7	7	7	7	7B	14	21	21A	21A
INDIA	7	7	7B	7B	7B	7B	14	14A	14	7B	7B	7B
JAPAN	14A	7A	7B	7B	7B	7	7	7	7B	7B	7B	14
MEXICO	14	7A	7	7	7	7	7	14	21A	21A	21A	14A
PHILIPPINES	21	7A	7B	7B	7B	7B	7B	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	14	14A	21A	21A	21	14
SOUTH AFRICA	14	7	7	7B	7B	14	14	21A	21A	21A	21	14A
U. S. S. R.	7	7	7	7	7	7B	14	21A	14A	7B	7B	7
WEST COAST	21	7A	7	7	7	7	7	14	21	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	7	7	7	7	7	7	7	14	14	21	21A
ARGENTINA	21	14	7	7	7	7	7A	14	21	21A	21A	21A
AUSTRALIA	21A	14	7A	7B	7B	7B	7B	7B	14A	21	21	21A
CANAL ZONE	21	7A	7	7	7	7	14	21	21A	21A	21A	21
ENGLAND	7B	7	7	7	7	7	7B	21	21A	14A	14	7B
HAWAII	21A	14	7	7	7	7	7	7	7	14	21A	21A
INDIA	7B	7A	7B	7B	7B	7B	7B	7B	14	7B	7B	7B
JAPAN	21A	14	7B	7B	7	7	7	7	7	7B	7B	14
MEXICO	14	14	7	7	7	7	7	14	14	21A	21A	21
PHILIPPINES	21A	7A	7B	7B	7B	7B	7B	7	7	7	7B	14
PUERTO RICO	21	7A	7	7	7	7	14	14A	21A	21A	21A	14A
SOUTH AFRICA	14	7A	7	7B	7B	7B	14	14	21A	21A	21	14A
U. S. S. R.	7	7	7	7	7	7B	7B	14	14A	7B	7B	7B

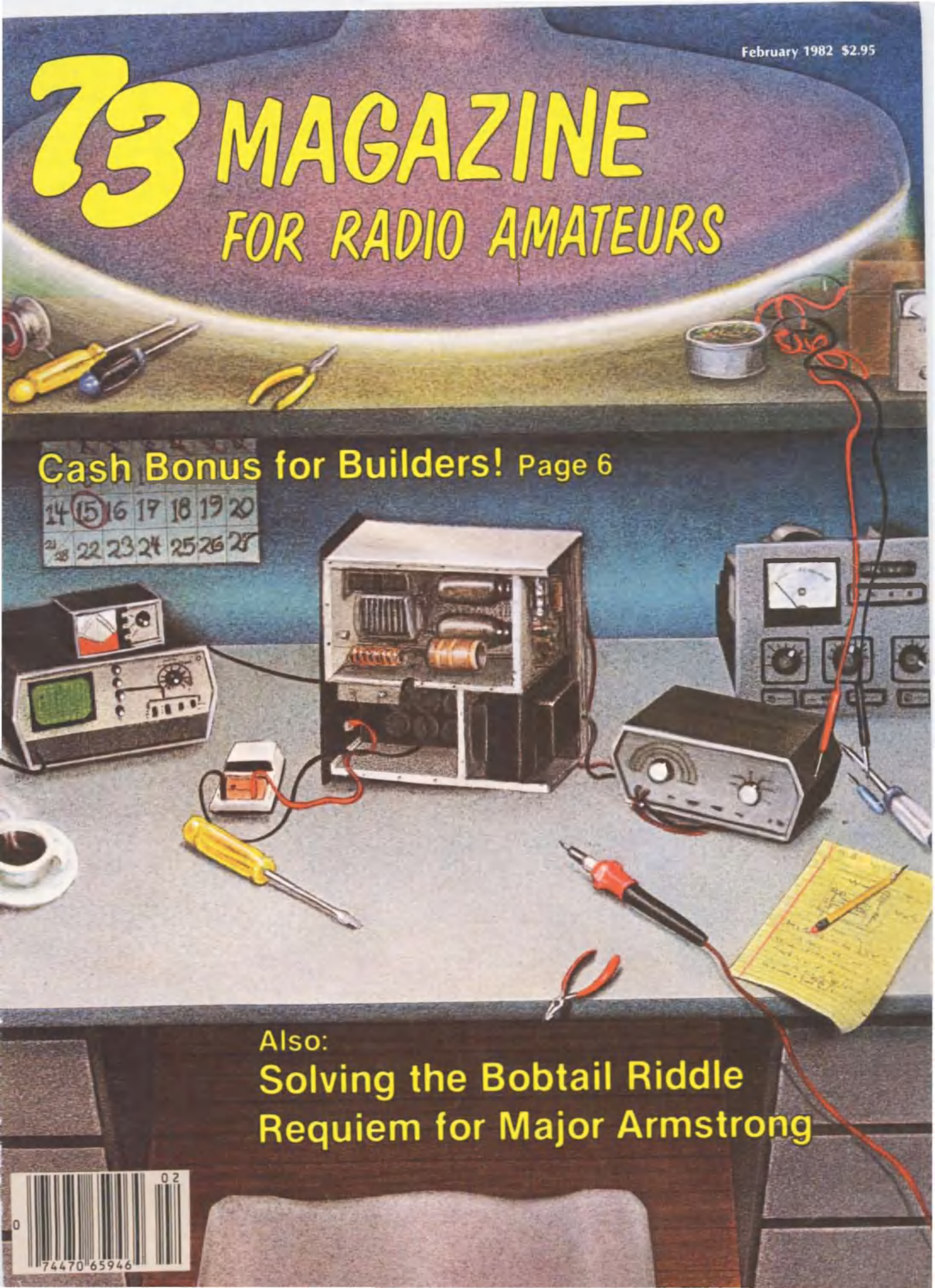
WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21A	14	7	7	7	7	7	7	7	14	21	21A
ARGENTINA	21	14	7A	7	7	7	7B	14	14A	21	21A	21A
AUSTRALIA	21A	21	14	7	7B	7B	7B	7B	14	21	21	21A
CANAL ZONE	21	14	7A	7	7	7	7	14	21	21A	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	7A	21	14A	14B	7B
HAWAII	21A	14	14	7	7	7	7	7	14	21	21A	21A
INDIA	14B	14	7B	7B	7B	7B	7B	7B	7A	7B	7B	7B
JAPAN	21A	14	14	7B	7	7	7	7	7	7B	14	21
MEXICO	21	14	7	7	7	7	7	14	14	21A	21A	21A
PHILIPPINES	21A	14	7A	7B	7B	7B	7B	7	7	7	7B	14A
PUERTO RICO	21	14	7	7	7	7	7	14	21	21A	21A	21A
SOUTH AFRICA	14A	14	7	7B	7B	7B	7B	14	14	21A	21	14A
U. S. S. R.	7B	7	7	7	7	7B	7B	7B	14A	7B	7B	7B
EAST COAST	21	7A	7	7	7	7	7	14	21	21A	21A	21A

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair G = Good
P = Poor * = Chance of solar flares; # = of aurora

January

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G/G	2 G/F
3 G/F	4 G/G	5 G/G	6 G/F	7 G/G	8 G/G	9 G/G
10 G/G	11 G/G	12 G/F*	13 F/F*	14 F/F	15 F/F	16 G/F
17 G/F	18 G/F*	19 G/F*	20 F/F*	21 F/P*	22 F/P	23 G/F
24 G/G 31 G/G	25 G/G	26 G/G	27 G/G	28 G/F	29 G/F	30 G/G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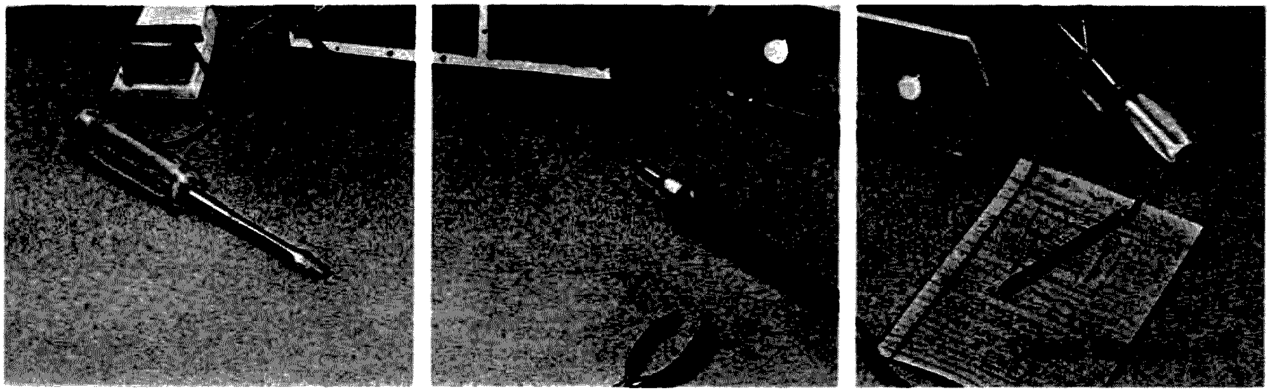
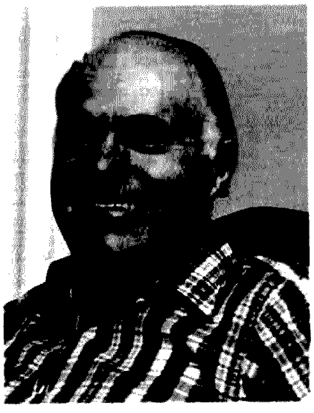


Cover: Pastel illustration by William Geise, Wilton NH.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



NOW, THE GOOD NEWS

The easy passage of the Goldwater ham bill through the Senate was certainly good news... and will bring closer some badly needed changes in the fundamental rules by which the FCC has had to operate.

Another bright spot was a bill entered in the House (in November) by Rep. Timothy Wirth of Colorado. Let me give you quotes on some of the provisions of this bill...

Authorize use of amateur volunteers for examination preparation

Section 4(f) is amended by adding at the end thereof the following new subsections:

"4(f)(4) Notwithstanding the provisions of Part III of Title 5, United States Code or 31 U.S.C. §665(b), for purposes of administering any exam-tion for an amateur station operator license, the Commission may accept and employ the voluntary and uncompensated services of any individual who holds an amateur station operator license of an equal or higher class than the class license for which the examination is being prepared. Any person who provides services under this paragraph shall not be considered, by reason of having provided such services, a Federal employee for any purpose."

Explanation

This proposal would provide a statutory basis for present practice at the Commission, and would allow expansion in the Commission's use of volunteers. The amendment would have no discernible effect on our budgetary requirements.

"4(f)(5) Notwithstanding the provisions of Part III of Title 5, United States Code or 31 U.S.C. §665(b), for purposes of administering any examination for any amateur station operator license, the Commission may accept and employ the voluntary and uncompensated services of any individual who holds an amateur station operator license of an equal or higher class than the class license for which the examination is being conducted. Any person who provides voluntary and uncompensated services under this paragraph shall not be considered, by reason of having provided such services, a Federal employee for any purpose."

Explanation

The present practice of the Commission is to permit volunteer licensees holding an Amateur Extra, Advanced, or General Class license who are at least 18 years of age to administer Novice Class operator license examinations. The proposed amendment would give statutory recognition to this practice and would allow the Commission to extend the practice to examinations for other classes, at the discretion of the Commission.

This program would help to conserve Commission resources and additional benefits would result from the fact that applicants would likely be able to take examinations within their communities, as opposed to having to travel to FCC field offices for testing.

Once the FCC has been authorized to let amateurs prepare and administer exams, we have the path open to set up a system whereby certain clubs might be able to hold classes to teach the needed theory, rules, and operation skills to prospective hams... followed by oral exams and a demonstration of skills.

While there are some amateurs who believe that the tension and panic of an FCC-administered exam are beneficial in some way, that was not my experience... nor the experience of anyone I've talked with about it. There seems to be a general concept that we should do everything possible to keep enthusiastic people out of the hobby rather than doing all we can to interest people in it... and making their entry an enjoyable experience.

There seems to be some wariness that we will suddenly find ourselves with a system where we are bringing in people who will be rotten hams and thus spoil the hobby. I would say two things to those worriers... first, we already have a fine system for bringing in lousy hams, one which has been working with a high degree of perfection. One has only to visit Los Angeles to get the full flavor of the 1980s-type ham in full bloom. It should be obvious that the present system of filtering out the weirdos is not working worth beans.

Secondly, I know of no one interested in opening the flood gates to CBers to come into amateur radio for a free ride. Not even CBers have suggested anything that preposterous. I do hear hams opposing it, but these chaps are merely fighting their own straw man, not anything ever seriously proposed. If some hams are gullible enough to get excited over such ma-

$$ HOME-BREW CONTEST $$

For some of us, there is no more satisfying experience than designing and building a piece of electronic gear. Now there's a chance for you home-brewers to receive special recognition for your achievements. It's the *73 Magazine* Home-Brew Contest.

Between now and April 1, we'll be looking for articles describing the best home-brew projects in the land for under $100. All useful projects will be published in *73*, and the cream of the crop will share $500 in cash prizes. Top prize in the contest is $250, with $100 going to the second place project and $50 to each of three honorable mentions. These prizes are over and above the payment that all authors receive for having their articles published in *73*.

Contest Rules

1. All entries must be received by April 1, 1982. To enter, write an article describing your best home-brew construction project, and submit the article to *73 Magazine*. Any construction article received before the April 1 deadline is automatically entered in the contest. If you haven't written for *73* before, please send an SASE for a copy of our author's guide.
2. The total cost of the project must not exceed $100, even if all parts are puchased new. Be sure to include a detailed parts list, with prices.
3. All parts used in the project must be available to the average radio amateur or electronics experimenter. To be on the safe side, include sources for any unusual components.
4. Projects will be judged by the *73* technical staff on the basis of usefulness, reproducibility, economy of design, and clarity of presentation. The decision of the judges is final.
5. All projects must be original, i.e., not previously published elsewhere.
6. All rights to articles purchased for publication become the property of *73 Magazine*.

Send your entries to:

Home-Brew Contest
73 Magazine
80 Pine Street
Peterborough NH 03458

Winners will be announced in the June, 1982, issue of *73*. Have fun!

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neuvers, then we should consider them part of the problem, not part of any solutions.

No, I think it is plain to just everyone that our present licensing system stinks. Here we have a Morse code test which a four-year old has passed with flying colors. . . big deal filter. We have a technical exam that few people even bother to study for. . . why bother when you can buy the test answers from Bash and just memorize the answers? That includes questions on rules, so we don't even have to know them anymore. It is no wonder that we have jamming of repeaters, foul language on the bands, stupid pileups of DX stations, and a situation on two meters in Los Angeles that has to be heard to be believed.

Not only are things going to hell in a basket, but we have the spectacle of thousands of hams doing all they can to protect this terrible system and make sure that we get even more of the same kind of hams.

Yes, I do have some ideas on what to do about the situation. And I think they will work. They certainly are right up the alley of the current FCC changes. The Commission has two major interests these days. . . deregulation and cutting expenses. I think that we can take advantage of these and at the same time improve amateur radio substantially.

Let's take a look at some basics. Firstly, yes. . . we do have some terrible hams in our ranks. But we recognize that, as much of a pain in the ass as these bums are, they are a distinct minority. Okay. . . there's a hint for us. . . a clue on how to start getting out of this miserable situation.

To me, one of the foundations of amateur radio is the ham club. I believe that every ham should belong to and support a ham club. This is one of the big strengths we have. This also is a key to our separating the good from the bad and the ugly, for few of the really bad eggs ever join clubs. The same behavior which makes them despicable on the air keeps them from having friends off the air. And what few do have the guts to come to club meetings, knowing what others think of them, are not thought well of for it. Thus, I suspect that the more we can involve our clubs in the training and licensing of newcomers, the better class of hams we will have on our bands. Perhaps we could even consider some sort of trial period for newcomers before their licenses are permanent so that we could observe them on the air.

We already know that the most vicious and obnoxious of people are quite capable of learning the code. In fact, since some of the worst hams we have had have been Extra class, perhaps there is some correlation between ugliness and adaptability to code (I'm kidding. . . aren't I?). I think that CW is one of the most treasured aspects of amateur radio, but I also think that the ability to copy the code is meaningless as far as determining whether someone is going to be a good ham. I think that once we make code ability honorable and stop forcing people to learn it for the test, we will take a lot more pride in it. Who can really take pride in something which he has to do, whether he wants to or not?

Clubs are an answer to many of our problems. If we are going to get amateur radio into any serious growth pattern we are going to have to have many more and stronger ham clubs. I would like to see ham clubs set up in every high school in the country. I'd like to know that every ham club has classes to teach newcomers the theory, the rules, and how to operate. If the Wirth bill goes through, it will open the way for clubs not only to teach the fundamentals of amateur radio, but also to make up and administer the exams. Talk about a service being self-sustaining!

This also would cut the cost to the FCC substantially. I don't know how much they are paying their people to keep writing new test questions to try to stay ahead of Bash and his cheat-sheets, but it must be a substantial amount. Then there is the cost of printing and distributing the tests. If the field personnel of the Commission did not have to sit around and administer exams they would be freed up for more productive work. . . or even to go into the private sector and earn money for taxes instead of spending it. We sure have a need for engineers and technicians these days in industry. . . a desperate need.

Monitoring

Another provision of the Wirth bill is as follows. . . .

Authorize use of amateur volunteers for monitoring

"4(f)(6) For purposes of monitoring any violation of any provision of this Act, and of any regulation made by the Commission pursuant to this Act, relating to the amateur radio service, the Commission, notwithstanding any provisions of Part III of Title 5, United States Code or 31 U.S.C. § 665(b), may (I) recruit and train any individual licensed by the Commission to operate an amateur station; and (II) accept and employ the voluntary and uncompensated services of such individual. For purposes of recruiting and training such individual, the Commission may also accept and employ the voluntary and uncompensated services of any amateur station operator organization. Any person who provides voluntary and uncompensated services under this paragraph shall not be considered, by reason of having provided such services, a Federal employee for any purpose."

Explanation

The volunteers' monitoring authority should include the monitoring of amateur licensees transmitting on frequencies not assigned to the service and is intended to permit volunteers to collect violation reports and annotate and summarize them for the convenience of the FCC.

Enactment of this proposal would enhance the Commission's enforcement efforts and bolster efforts to detect and prosecute rule violators. To ensure that a volunteer monitoring program helps rather than hinders the enforcement program, it is important that violation reports undergo preliminary review by volunteer organizations to help FCC personnel determine which alleged violations represent the most promising targets for the Commission's limited enforcement resources.

This amendment would not increase our budgetary requirements. It may help us to conserve our enforcement resources or, at least, improve the efficiency of our enforcement program.

If the Commission is to fully utilize the services of volunteer amateur licensees for monitoring, as envisioned by this proposal, there should be *an exception to Section 605 to permit the monitoring groups to receive and disclose information transmitted by amateur licensees and operators (See proposed amendment to Section 605, infra.)*

Exempt amateur radio communications under certain circumstances

Section 605 is amended by striking the last sentence thereof and adding the following:

Continued on page 131

Mark Oman WAØRBR
528 Deines Court
Ft. Collins CO 80525

The Fun-Oscillator

—a simple, goof-proof vfo for your QRP transmitter

Note: A complete kit of parts, including PC board, is available from RADIOKIT, Box 411S, Greenville NH 03048 for $34.95 plus $2.50 shipping and handling.

The Fun-Mitter (February, 1981, *73*) and Fun-Ceiver (July, 1981, *73*) provided the home-brew-oriented amateur with the basic components for a home-brew station setup.

Many amateurs have responded by saying that they need more frequency flexibility for their Fun-Mitters.

The simple vfo described in this article is the result of those requests. It allows greater frequency excursions than the simple vxo circuit of the Fun-Mitter to provide approximately the same frequency coverage as the companion receiver. The vfo follows the same guidelines as the two previous articles and should be as easy (or easier) to construct and to get operational.

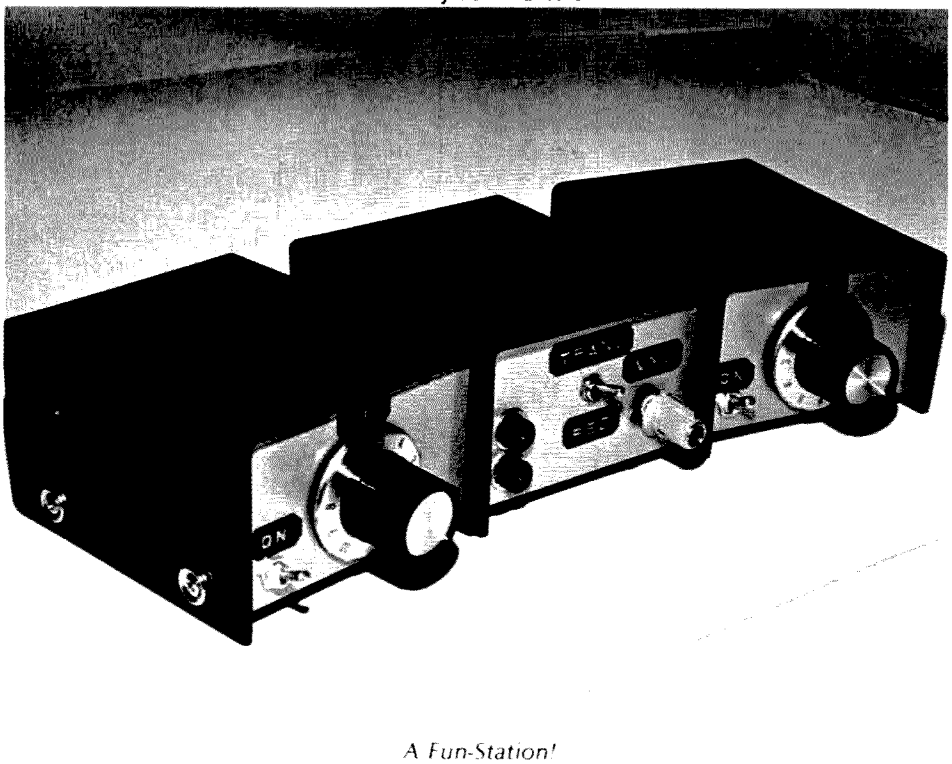
For those unfamiliar with my earlier articles, this series of articles focuses on simple, easy-to-construct, easy-to-operate gear with all parts available from local Radio Shack outlets. Size and appearance of the vfo match the transmitter and receiver to provide a nice looking station package.

Of utmost importance is the fact that no modifications have to be made to the Fun-Mitter to use the vfo. It simply plugs in where the crystal was (unless C_{opt} was installed). This allows for either crystal or vfo operation of the Fun-Mitter. Also, it can be constructed for either 40 or 80 meters. It provides about 70 kHz of coverage on 40 meters and about 50 kHz on 80.

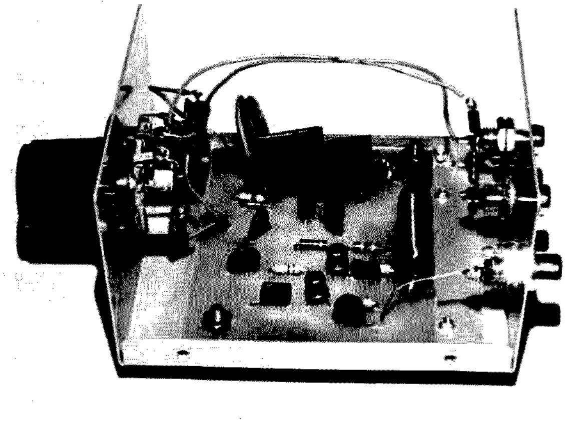
The Circuit

The vfo should be the most goof-proof of all three pieces of gear as evidenced by the schematic of Fig. 1. The basic frequency-determining portion of the vfo is identical to the vfo of the

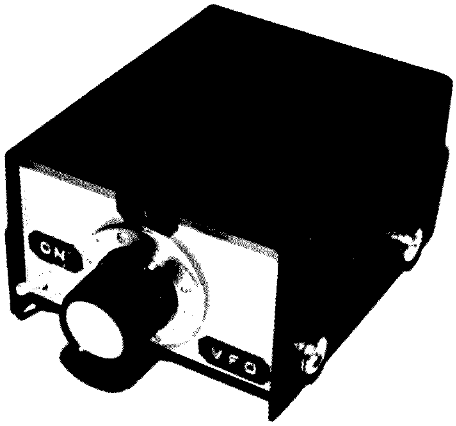
Photos by Duane Bertsch



A Fun-Station!



Internal view of vfo.



Front view of the completed Variable Fun-Oscillator.

Fun-Ceiver. This allows for ease of understanding and construction as well as similar frequency range.

Before I began this series, I developed a set of guidelines for the items to be designed. Based on this criterion of setting goals in advance, I developed the following goals for the simple vfo.

- Good performance (no chirp, minimal draft, clean waveform)
- Simple construction (PC board use, less than four hours total build time, minimum parts count)
- Cost—less than $20 with new parts
- Minimal modification to the Fun-Mitter
- Full output from the Fun-Mitter
- No variable capacitors or inductors

The final version of the vfo meets the above goals.

Only three transistors are used in the vfo, one as the oscillator (Q1), one as a class-A amplifier (Q2), and one as an emitter-follower buffer (Q3). This final version of the vfo went through three revisions from the original form. This was necessary to maintain good performance while still keeping things simple. The original design included only two transistors, but at times chirp was detected on the transmitted signal. The main advantage of the circuit of Fig. 1 is that only one tuned circuit is used (L1). This means modifying only one inductor!

Q1 operates as a parallel-tuned Colpitts oscillator with L1, CR1, CR2, C1, C2, and C3 being the frequency-determining components. The oscillator is tuned by varying the voltage at the junction of the two diodes. This, in turn, varies the capacitance of the diodes which varies the frequency of the oscillator. L1 is a modified Radio Shack 10-μH rf choke. It is modified, as described later, to provide the needed inductance. The last few turns of the modified choke are spread out over the choke body to provide an easy means of setting the oscillator frequency.

As mentioned in the receiver article, the capacitors needed to build a stable vfo are not easily found at Radio Shack. NPO-type capacitors from a large variety pack again are used in parallel and series combinations to obtain the needed capacitance for C1, C2, and C3. Silver-mica or polystyrene capacitors will give even better results.

Output from Q1 is taken through a coupling capacitor, C4. This capacitor should be kept as small as possible to isolate the oscillator from load variations which can cause chirp. The capacitor is attached to the next stage, Q2, a class-A amplifier. This amplifier raises the level of the signal to the level needed to drive the Fun-Mitter.

Q2 is direct-coupled to the final stage, Q3, an emitter follower. This stage provides excellent isolation between the oscillator and the transmitter as well as providing an impedance match between the two. Without Q3, as in the original design,

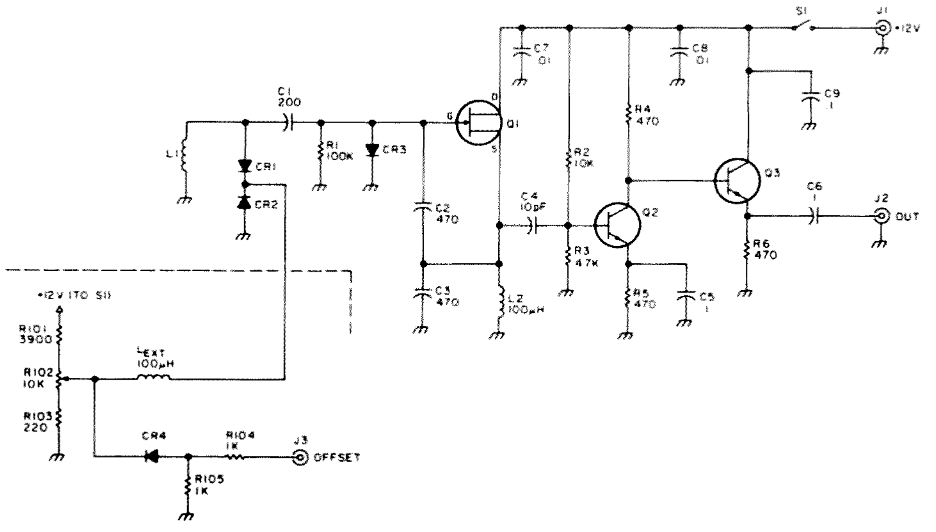
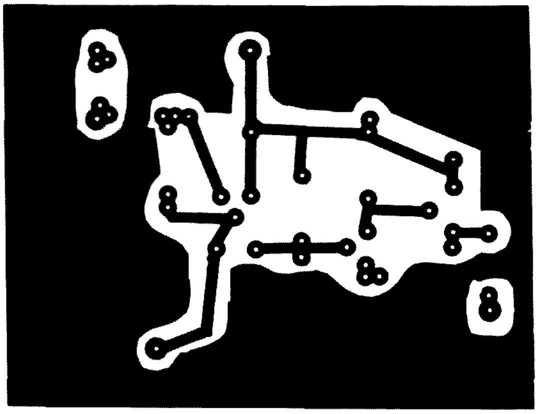
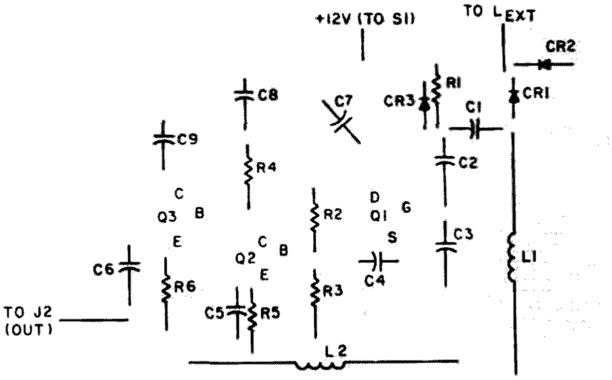


Fig. 1. Schematic of vfo.



PC layout for vfo.



Component location.

PC boards for the vfo are available from the author for $7 ppd. PC boards for the previous articles also are available as follows: Fun-Mitter—$7 ppd; Fun-Ceiver—$7 ppd; Filter—$3.50 ppd.

Parts List

Designator	Value	Radio Shack Part Number
C1	200 pF NPO (approx.)	272-801
C2, C3	470 pF NPO	272-801
C4	10 pF (use two 4.7 in parallel)	2-272-120
C5, C6, C9	0.1 μF	272-135
C7, C8	0.01 μF	272-131
CR1-CR4	1N914 On 80 meters, for CR1 and CR2, use two 1N914s in parallel for each (piggyback)	276-1122
J1-J3	phono jack	274-346
L1	80m: Two 273-101 inductors in series; one with no turns removed, one with 10 turns removed 40m: 10 turns removed from 273-101 inductor. For both 80 and 40 m the last 3 turns of the modified inductor should be spread out over rest of the form	
L2	100-μH inductor	273-102
Q1	FET	276-2035
Q2, Q3	RS2033	276-2033
R1	100k, 1/4-W	271-1347
R2	10k, 1/4-W	271-1335
R3	4.7k, 1/4-W	271-1330
R4-R6	470Ω, 1/4-W	271-1317
Not on PC board:		
L_{ext}	100-μH inductor	273-102
R101	3.9k, 1/4-W	271-1329
R102	10k linear pot	271-1721
R103	220Ω, 1/4-W	271-1313
R104, R105	1k, 1/4-W	271-1321
S1	SPST switch	275-612
case		270-251
knob		274-392

the vfo is not stable when the transmitter is keyed.

CR4 is used to shift the frequency of the vfo when the transmitter is not in use and you are listening to the receiver. It does this by changing the voltage at the junction of CR1 and CR2, which shifts the oscillator frequency. Without this feature, the vfo signal would appear on the listening frequency and make listening impossible!

Construction

The construction of the vfo is intended to be goofproof. It is built on a 2¼″ × 3″ single-sided board just as the transmitter and receiver were. It cannot be overemphasized that the circuit should be built on a PC board. Nearly all of the problems that readers had in building the previous two pieces of gear were due to breadboard or point-to-point construction. If you are an inexperienced homebrewer, it is fairly easy to make mistakes when wiring the circuit apart from a printed circuit board.

I built my vfo in an enclosure that matches the enclosures used for both the transmitter and receiver. Also, the front-panel layout was made compatible to enhance the appearance of the gear.

As can be seen in the photographs, the tuning potentiometer (R7) is mounted on the front panel. The associated resistors and inductor (R6, R8, L3) are also mounted on this potentiometer, and wires run from there to the appropriate circuit points.

The rear panel contains three jacks. One is for the vfo output signal, and one is for the vfo offset. The connection between the vfo and transmitter should be made with coaxial cable (RG-174 or RG-58).

Operation

The vfo is best operated with a battery rather than an ac supply. This eliminates any possibility of ac hum on the transmitted signal. It also helps improve frequency stability. Two 6-volt lantern batteries in series will power the vfo for a long period of time. If the Fun-Mitter is powered by batteries, the needed 12 volts can be tapped from those batteries.

Tuning and operation are very easy: Only one adjustment needs to be made—setting the vfo on frequency. This is accomplished in the same manner as was done in the receiver. Using a separate receiver, listen on the frequency you want the low end of the vfo to be set on (for example, 7100 kHz). Drape a length of wire near the vfo and attach the other end to the receiver

antenna input. With the vfo on and warmed up, slowly spread or compress the last few turns of L1 until the vfo signal is heard in the receiver. This adjustment should be done with the tuning potentiometer (R7) fully counterclockwise. Finally, verify that the vfo covers approximately 70 kHz if built for 40 meters and 50 kHz if built for 80. That's all there is to the adjustment.

To operate the vfo, two connections need to be made—one to the transmitter crystal socket and one from the vfo offset input to J3 of the Fun-Mitter. (This jack was added to provide receiver mute operation for the Fun-Ceiver.)

If C_{opt} was not included in the Fun-Mitter, then the vfo signal can be applied directly to the crystal socket terminals (see Fig. 2). If C_{opt} was included, remove its connection and connect that terminal of the crystal socket to ground. An inspection of the Fun-Mitter schematic will reveal that even this step is not necessary if a method can be derived to connect the shield of the vfo cable to ground of the Fun-Mitter. Alternatives such as a rear-panel phono connector on the Fun-Mitter also can be used. A plug can be made easily from two ½" to ¾" lengths of #12 gauge copper wire. Solder the vfo signal and ground leads to these wires and plug them into the appropriate crystal socket pins.

Once the vfo is plugged in and turned on, verify that the transmitter operates as it did before. With the vfo in use and all connections in place, the vfo signal should be heard only when the transmitter is in the transmit mode (due to the vfo offset feature). Zero-beat the vfo with the transmitter in the transmit position and the key down. Remember that when using a direct-conversion receiver, you must zero-beat the correct side of the signal you are listening to.

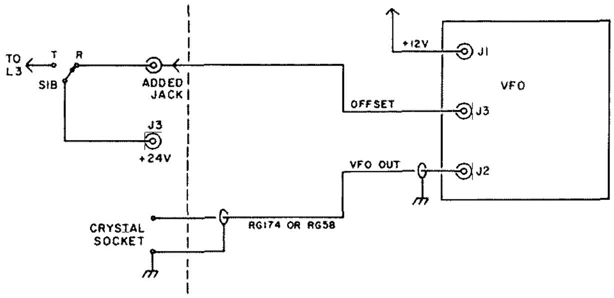


Fig. 2. Connections between vfo and Fun-Mitter.

Crystal operation still can be used by simply removing the vfo leads and plugging the crystal back in.

It should be possible to use the vfo with low-power solid-state transmitters other than the Fun-Mitter. However, modifications may be necessary to the transmitter if the oscillator is not configured as in the Fun-Mitter.

Conclusion

The vfo should be simple to build and goof-proof in its operation. Many more contacts now should be possible due to the ability to move to the frequency the other station is on. This series will be continuing in the months to come with additional goof-proof projects. Meanwhile, enjoy the Variable Fun Oscillator! ■

THE RTTY ANSWER

IRL

Build this Antennalyzer

—you'll need a weekend

Photos by W1GSL

Penn Clower W1BC
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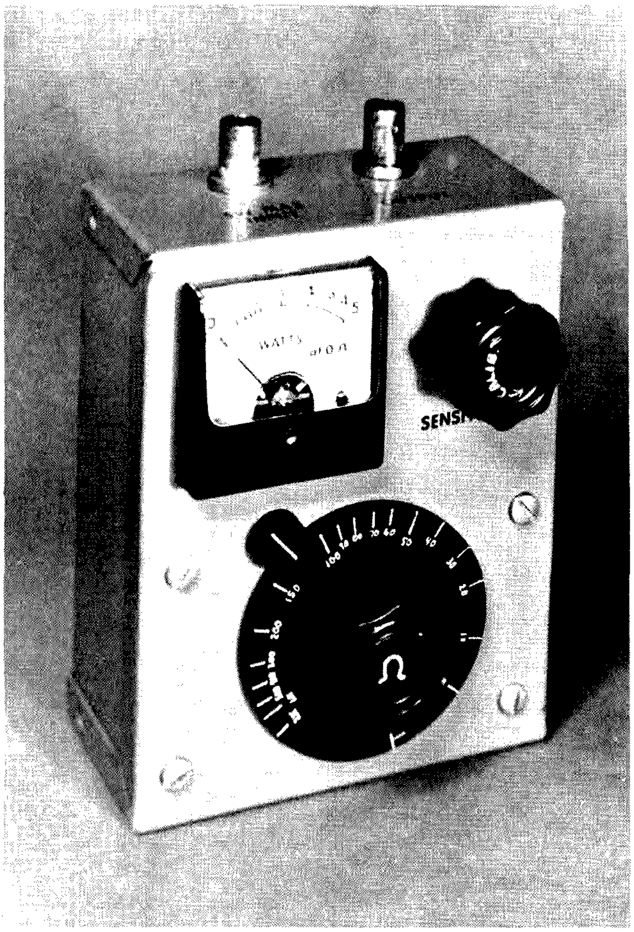

Photo A. Front view of the dummy load/wattmeter/rf bridge. The resistance dial is a 2-1/4" diameter plastic skirt attached to a standard knob.

Here is a weekend project that combines two instruments and an old technique into a very handy gadget to have around the shack. First, it's an 8-to-10 Watt 52-Ohm dummy load with a calibrated wattmeter: perfect for tuning up low-power transmitters. Second, it's also a calibrated rf resistance bridge which can make antenna adjustments a lot easier by telling you more about the nature of a mismatch than a plain swr bridge will. The old technique provides a nice tie-in between these two instruments and gives some benefits besides: The dummy load is also a resistive power divider that provides a low-level driving signal for the rf bridge.

One benefit of this arrangement is that the power source sees a load which is essentially independent of the bridge load. That means you can load your QRP transmitter into this instrument, put that new antenna on the bridge output, and fool around to your heart's content without risk of damaging the transmitter or even detuning its output stage. In addition, the power delivered to a 50-Ohm load is only about 40 mW when the power coming out of the transmitter is 5 Watts. That is a 21 dB reduction, and it means that any signal you radiate while adjusting the antenna is 3-1/2 S-units less than it might have been—certainly a neighborly gesture on today's crowded bands.

Background Theory and Circuit Description

There is nothing new or unique about the circuits described here. Rf resistance bridges have been around longer than the more familiar high-power swr bridges and there are several examples in recent publications.[1,2] The dummy load/power divider technique was described in *Solid State Design for the*

Radio Amateur (ARRL) and recently used in a transmatch tuning circuit described in *QST*.[3]

What I hope to emphasize here is this instrument's usefulness as a matching aid, the simple and inexpensive nature of the circuit, and the fact that the same circuit can be used as a dummy load with a built-in calibrated wattmeter. It's like getting two instruments for the price of one, and the final result is a very handy piece of test gear.

The resistive rf bridge is a simple modification of the classic low-power swr bridge, so before getting down to circuit details let's consider swr bridges in general for a moment. There are two main types of bridges used for measuring swr, and the most common type is a high-power handling circuit meant to be left in the transmission line for continuous monitoring. Usually, this type of bridge requires a minimum of 5 Watts or so driving the load before the meter readings are large enough to interpret accurately. This occurs because the bridge itself is very loosely coupled to the transmission line, typically through a few picofarads or several inches of wire running parallel to the center conductor of the main line.

The other type of bridge is inherently a low-power instrument. The driving signal runs right through the resistive elements which make up the bridge, so the bridge itself must be able to absorb a large fraction of the input power. The resistive bridge doesn't find much use in amateur circles because it requires only a Watt or less of drive and can't be left permanently in the line; it's strictly an occasional-use test instrument.

There is nothing wrong with continuous swr monitoring. After all, the familiar deflections of the high-power monitor do give a constant verification that the transmitter is tuned and the antenna connected. The low-power test instrument described here has some advantages over the usual swr bridge, though, especially for initial antenna adjustments, because it tells you more than just the magnitude of a mismatch.

Swr can be defined several ways, and one is the ratio of a load impedance to the transmission line's characteristic impedance (which is almost always near 50 Ohms in current amateur usage). For example, to cause a 3:1 swr, a 50-Ohm cable could be terminated with either 150 or 16.6 Ohms. These are purely resistive loads, but there is also an infinite number of reactive loads which would give the same 3:1 swr, and a common swr bridge can't tell the difference between any of them. You can build a bridge to measure both the reactance and resistance present in a load,[4,5,6] but such bridges tend to be too complex for my taste and requirements.

When matching a load to a 50-Ohm line, I generally have two questions. Is it resonant, and what's its resistance? If a load is resonant (and that's how I want all my antennas to be), then it has no reactive component—just resistance. If I know the value of that resistance, then I know the swr and whether I need more or less resistance to get a match. I'll give an example at the end of the article, but right now let's look at the schematic shown in Fig. 1.

There really isn't much to the circuit diagram. The input signal is terminated in a 53-Ohm dummy load constructed with a series-parallel resistor assortment. The voltage development across the 10-Ohm portion of that dummy load drives a simple bridge circuit made up from a 250-Ohm pot, a 51-Ohm standard resistor, and the load impedance. The bridge error signal appears between the output connector and the potentiometer arm and is detected by a germanium diode. The result is then indicated by a 100-uA meter in a voltmeter circuit.

Bridge operation is equally straightforward. When input power is applied to the instrument, it develops a voltage across the 53-Ohm dummy load. About 1/5 of this voltage appears across the 10-Ohm portion of the dummy, and this is the driving voltage for the resistance bridge. Some fraction of this driving voltage shows up between the potentiometer arm and ground, the exact amount depending, of course, on the shaft position. Similarly, there is some other fraction of the bridge driving voltage appearing across the load terminal, this fraction depending on the load resistance connected there.

If there is no load connected, then the entire source voltage appears there and we'll make use of that fact later to calibrate the wattmeter portion of this instrument. If a 51-Ohm load is connected, then exactly half the source voltage will be there. The difference between the output voltage and the potentiometer arm voltage is rectified by the diode and drives the meter through the sensitivity control, so with the 51-Ohm load the bridge will show a null when the pot travel is exactly centered. Other load resistances will show nulls at other positions and the potentiometer dial may be calibrated by marking the nulls corresponding to a whole series of load resistances. In theory, the bridge should show nulls for every load resistance between zero and infinity, but in practice this doesn't happen because the potentiometer isn't infinitely adjustable.

The circuit can be calibrated pretty accurately for resistances between 5 Ohms and 1k, with the best resolution around the center of the dial at 20 to 150 Ohms. Notice that the bridge cannot be nulled completely if the load has a capacitive or inductive component since such a load would introduce a phase shift between the bridge source voltage and the bridge load voltage. As there is no corresponding phase shift between the bridge source voltage and the potentiometer arm voltage, there never will be a point where the diode voltage will be zero and the meter nulled. Even when the voltages at each end of the diode are equal in amplitude, the fact that they are phase-shifted with respect to each other guarantees that there will be a sine wave or error voltage for the diode to rectify. In practice this means that unless the load is a pure resistance there will not be a true null but only a partial dip in the meter reading as the potentiometer shaft is turned.

A true rf impedance bridge would have two null adjustments: one for rf resistance and one for reactance. With such a bridge you can completely define any mismatch, but, as noted earlier, that's often unnecessary, especially in antenna work where the goal is to tune out reactance by resonating the antenna. You can always tell when a load is resonant with the resistance bridge because at resonance the null will be complete. Then steps can be taken if necessary to transform the remaining impedance to match a 50-Ohm line.

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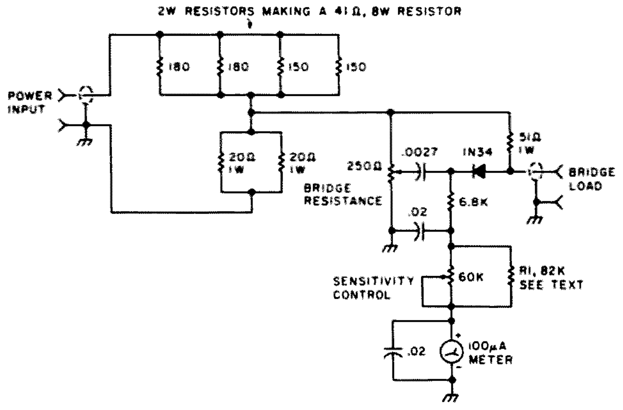

Fig. 1. Schematic diagram of dummy load/wattmeter/rf bridge. R1 is chosen as necessary to calibrate the wattmeter.

This same bridge circuit can be used to measure the power delivered to the dummy load by the transmitter. A glance at the schematic will assure you that with no load connected to the bridge and the resistance dial set to zero Ohms, the voltmeter circuit will indicate the rf voltage across the 10-Ohm portion of the dummy load. Knowing that voltage, we can easily calculate the voltage across the whole dummy resistance, and knowing that, we can calculate the power there from $P=V^2/R$. The calibration can be accomplished using only a dc voltmeter and will be described shortly.

Construction

A lot of articles begin their construction description with the assurance that "the layout is completely noncritical." That is certainly not true here, but "critical" is also too strong of a word, so let me just caution you to be careful with layout. There are three main areas that can cause trouble.

First, it's best to arrange the dummy load portion of the circuit so that current flowing in the ground path from the bottom of the dummy load back to the input terminal does not share any conductor with part of the bridge circuit. If it does, then variations in the input power will shift the null positions on the resistance dial. Photo B shows one way to solve that problem by bringing the input power and its ground return to the dummy resistors on a single piece of coax, thus avoiding the temptation to ground the bottom resistors to some point on the chassis.

Second, the detector diode should have one end connected directly to the output jack. My first few attempts had more compact physical arrangements with the diode connected to the bridge output terminal with lengths of wire or brass strips. This always interfered with getting good deep nulls on both ends of the resistance range.

Third, the detector should not be a silicon diode, since the 0.6-volt threshold of a silicon diode will cause the bridge nulls to be too wide. With a given load termination there should be a single, sharp deep null on the dial, not a dead zone covering several degrees of rotation. My collection of diodes is pretty large, and the best of the lot turned out to be some germanium 1N34 equivalents I paid 10¢ each for some 15 years ago! Radio Shack's 276-1123 diodes cost the same today and should work as well.

The dummy load nominal value is about 51 Ohms with the circuit shown. I used an assortment of resistors from the junk box, so feel free to substitute values, but do observe a few simple rules. Wire-wound resistors are definitely out because they look like coils at radio frequencies. Also, stick with carbon resistors having values less than 1k. When paralleling resistors, try to have them all of the same value so they dissipate equal amounts of power. Keep the leads short and the wiring direct; this keeps the dummy load looking resistive at the higher frequencies and prevents stray coupling which might interfere with the bridge nulls.

The rest of the physical arrangement is pretty clear from the photographs with the exception of the bridge potentiometer mounting. A similar bridge is described in W6SAI's 1962 *Radio Handbook*[7] and the author there cautions that stray capacitive coupling between the potentiometer resistive element and ground can cause frequency sensitive errors in calibration.

The suggestion made there, and followed here, is to cut a large hole in the box (say, 1-1/2" in diameter) and mount the pot in the center of this open space using a piece of insulating plastic, bakelite sheet, or unplated circuit board for support. This insulates the pot body from ground and thereby greatly reduces the capacitive coupling between the pot resistive element and ground. It seemed like a good suggestion so I followed it. I can't strictly say it is necessary because I didn't try it the other way, but it sure can't hurt.

The skirt on the resistance dial covers the hole from the front of the box. If you want to use a smaller knob with a pointer, you could mount a rectangle of insulation over the hole from the front side of the panel and use that to hold the pot and the calibration marks. The actual value of the bridge potentiometer is not too critical. It should be at least 50-Ohms so that it doesn't draw too much power, and anything over 1k is probably asking for trouble with stray capacitance. If you have anything inside that range, try it before you buy a new 250-Ohm unit.

The box shown is a cut-down Bud minibox that started out as 3" × 4" × 5". The 3" height was reduced to just under 2" because it fit the hand better, but there is nothing magic about these dimensions. Use anything of roughly the same size as long as it is made of metal. You also will note in the photographs that BNC connectors are used instead of the more common (in amateur circles, anyway) UHF series. I don't run enough power to require RG-8, and I find the smaller quick-connect BNC connectors more convenient for my home-brew projects. Naturally, if all of your antenna cables have UHF connectors, then you also should use them on your bridge.

Calibration

There are two things to calibrate here: the wattmeter and the bridge scale. The meter serves as a null indicator when using the bridge, so the wattmeter calibration can be done after the bridge has been checked out.

The bridge dial can be as simple or fancy as desired but it should be large enough to read easily. The skirt on my dial is 2-1/4" in diameter. You probably will want to start with a paper scale and save the fancy artwork until everything is working properly.

Assemble a collection of carbon resistors covering as

many values as possible between 5 and 1000 Ohms and then cut the leads to about 1" in length. The leads are bent so the resistors can be spring loaded into contact with the bridge output connector. If you have a lot of spare connectors, you also could make up a number of dummy loads with the different resistors similar to the one shown next to the bridge in Photo B.

Any layout problems will be more pronounced at the higher frequencies, so fire up a 10-meter rig if you have one and feed several Watts of rf into the bridge. (I've used this instrument only on 10 meters, but it might work all right up to 6 meters.) With the bridge excited, check the nulls at both ends of the range, say, with a 10-Ohm then a 680-Ohm load.

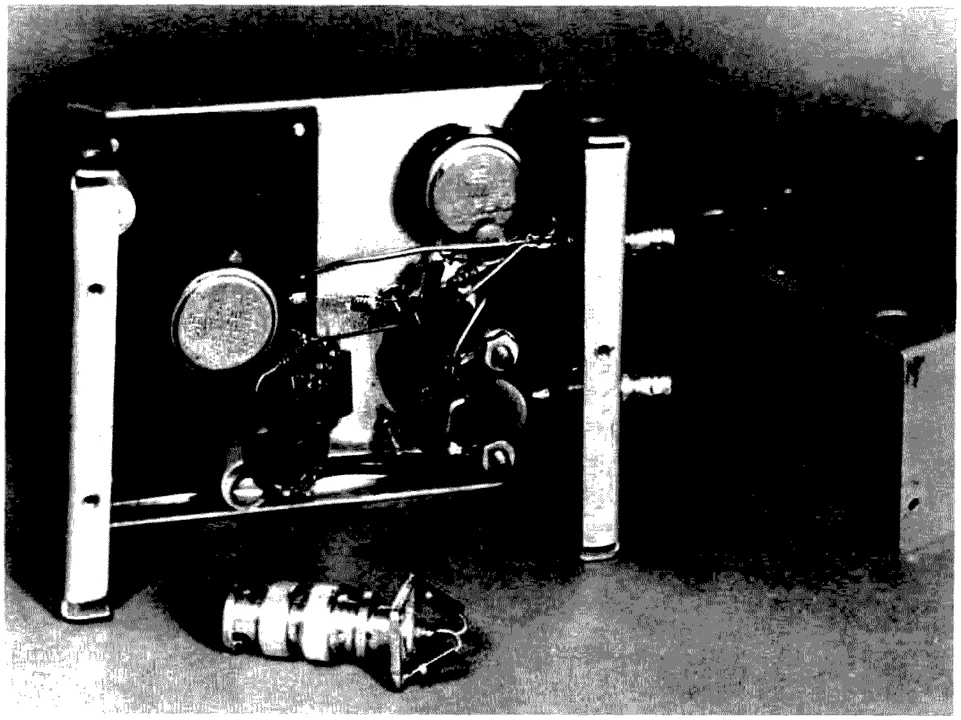

Photo B. Interior of the instrument, showing layout and construction details. The object in the foreground is a dummy load typical of those used during calibration.

Both nulls should be deep and well defined. If one isn't as deep as the other, then there is probably something wrong with the physical layout of the bridge elements. Try moving things around some or try another ground routing. If you followed the layout shown, then there really shouldn't be any trouble. Remember that this is an rf resistance bridge and with resistors on the bridge output, the nulls theoretically should be right down to zero meter movement. In practice, stray reactances prevent the nulls from being perfect but they should come pretty close to it. If the load does contain some reactance, there still will be a dip but it won't be to zero as previously mentioned.

When you're satisfied with the basic bridge operation, make a temporary scale and mark off the positions of the nulls due to the collection of sample resistors. Standard resistor values aren't nice round numbers, but with enough calibration marks you can make a final scale with lines at 5, 10, 20, 30, etc., Ohms as shown on the front panel in Photo A.

The wattmeter scale can be calibrated easily using a dc power supply and a good dc voltmeter. Remember that the wattmeter is actually reading the rf voltage across the 10-Ohm portion of the dummy load when there is no bridge load and the bridge pot is set to zero Ohms. Under these conditions, the 0.0027-uF coupling capacitor (that's not a critical value—anything from 0.001 to 0.05 will work as well) will charge to the peak value of the rf sine wave.

Since the peak value of a sine wave is 1.414 times the rms value, it is easy to calculate a dc value which, when fed into the instrument, will read the same on the meter as some given rf power. A conversion chart for the 53-Ohm dummy load is given in Table 1 along with the equation necessary to calculate your own equivalents should you use some other combination of resistors. Since I was interested in converting CB sets, I calibrated my wattmeter for a full-scale reading of 5 Watts, even though the resistors can handle 10 Watts for short periods. To make the 5-Watt calibration, feed a measured 22.9 volts into the unit, turn the sensitivity control all the way down (maximum resistance), and select a value for R1 that gives a full-scale meter reading.

Now comes the hardest part: making the meter face. I don't like conversion charts so I made a whole new face for my meter. It's not as difficult as you might think, but it does require a steady pair of hands.

Open the meter, remove the two screws holding the faceplate in place, and remove the faceplate while taking care not to damage the meter pointer. Glue a clean piece of white paper over the old faceplate using paper paste and not liquid white glue (which tends to dampen the paper so much that it wrinkles). Be sure to cover the faceplate evenly with paste so the paper won't have a chance to wrinkle. The pointer travels close enough to the faceplate that it can get stuck on wrinkles.

When the paste is dry, use a sharp knife to trim off the excess paper, and a pin to punch through the screw holes. Now a drawing set with an ink compass can be used to draw in a nice arc for the baseline of the new scale. Remount the faceplate, center the meter zero adjustment, and make a light pencil mark under the pointer tip to define the zero rest position. Reapply the 22.9 volts and make another pencil mark to spot the 5-Watt full-scale position. Now go down the list in Table 1 and mark off each intermediate point, checking occasionally that all of the points are repeatable and properly marked.

Finally, remove the faceplate again and finish off the scale graduations with

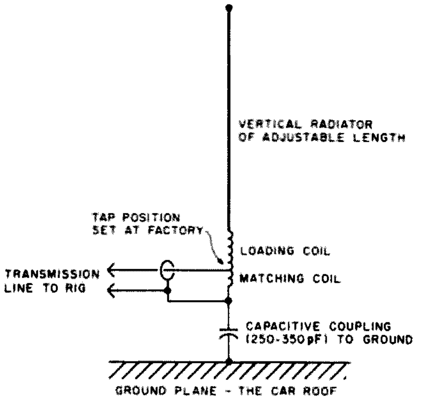

Fig. 2. Shortened loaded vertical, a CB mag-mount whip.

ink or dry transfers using the light pencil marks as a guide. With a little care, the results can be pretty professional. One real bonus of this technique is that the calibration is correct with the particular diode, resistors, and meter actually used, since the whole circuit is calibrated at once. That's important because the diode is not a perfect rectifier and the meter scale will be influenced slightly by the characteristics of the particular diode used.

An Application Example

The most obvious use for the rf resistance bridge is in making matching adjustments to antennas. Some antennas, dipoles, for example, are easy to adjust with an swr bridge since their feedpoint impedance at resonance is already close to the typical cable impedance. When a dipole is fed with either 52- or 73-Ohm coax, its swr at resonance is bound to drop to somthing like 1.5:1. This isn't true with shortened antennas such as mobile whips since their feed impedance may be only a few Ohms.

Input Power Watts	Dc Voltage Equivalent
5.0	22.90
4.0	20.49
3.0	17.74
2.0	14.49
1.0	10.24
0.5	7.24
0.4	6.48
0.3	5.61
0.2	4.58
0.1	3.24

Table 1. Wattmeter calibration. Input power levels corresponding to dc voltage equivalents. Values are calculated using $E = \sqrt{2RP}$, where P = rf power (in Watts), R = total dummy resistance, and E = dc input voltage (where E is peak value of rf sinewave). Caution: With these dc inputs, the dummy load is dissipating twice the indicated rf power, so be careful not to overheat the resistors.

There are two adjustments necessary to get a low swr with such an antenna: one for resonance and one for impedance matching. Making these two adjustments with only an swr bridge can be very difficult because a low swr will result only when both settings are correct. With a resistance bridge, the adjustment is much easier.

Consider the antenna shown in Fig. 2, a magnetically-mounted, base-loaded CB whip. The antenna really has two adjustment points, although the tapped loading coil is normally adjusted and sealed at the factory and all that is necessary for 27-MHz operation is a slight height adjustment. Putting this antenna to use on 10 meters or using a different length whip section may change things enough that a low swr cannot be achieved without a change to the coil size or tap position.

For example, I am using one of these antennas on the roof of my house as a loaded ground plane. The eight 1/4λ radials laid out on the roof do not provide the same type of ground return as the roof of an automobile. In addition, a 5' whip is being used as a radiating element in place of the original 3' length. This longer length lets me use a smaller loading coil with lower losses. I built this test instrument partly because of the difficulty I was having trying to tune this antenna with only an swr meter and grid dipper.

Adjusting such an antenna is a lot simpler with the rf resistance bridge, but first the bridge must somehow be connected to the base of the antenna. It would be nice to locate the bridge physically at the base of the antenna but this isn't always practical. For one thing, the bulk of the operator's body would probably upset the antenna tuning. If the bridge is connected to the antenna through a length of coaxial cable then that cable length must be chosen carefully because the impedance seen looking into a transmission line depends on three things: the line impedance, the load impedance, and the line length.

Luckily, it happens that a section of transmission line which is some multiple of a half wavelength in length will have an input impedance almost exactly equal to its load impedance. Using such a line makes it possible for the bridge to be located at some convenient position and still indicate the antenna base impedance. At 28.5 MHz, a half wavelength in free space is 16' 5" and in coaxial cable it will be about 2/3 of that or 10' 11".

If you have a section of cable this length, it is easy to check its electrical length with the bridge. First put a 10-Ohm resistor directly on the bridge and check for the null at 10 Ohms. Then insert the cable section between the bridge and resistor and see that the bridge still reads a resistive 10 Ohms. If it is a little off, as indicated by an incomplete null somewhere near 10 Ohms on the dial, you may want to change the transmitter frequency a bit to adjust the operating wavelength to the line's physical length.

Just for fun, you might try a quarter wavelength of cable and verify that it transforms the 10 Ohms into 270 (52-Ohm cable). In fact, you might get out a good article on transmission-line matching sections and try a number of things with different loads and line lengths—it's fun and really brings that dry old theory to life.

With the antenna fed through some multiple of a half wavelength of cable, the radiator length can be adjusted for resonance as indicated by a complete null of the meter reading. The resistance indicated at resonance is the feedpoint impedance of the antenna, and the ratio of that impedance to 52 Ohms is the swr on the cable—assuming you're using 52-Ohm cable. If the swr is more than 2:1 (antenna impedance greater than 100 or less than 25 Ohms), then you may want to change the coil tap position. It probably is easier to change the inductance below the tap by squeezing or separating the coil turns there slightly than it is to unsolder and move the tap itself. These adjustments can be pretty fine and you probably won't end up changing the coil size by a whole turn's worth anyway.

With the inductance changed, look for the new null on the bridge and, once again, adjust the antenna

height until the feedpoint impedance is pure resistance. Depending on whether that resistance is closer or further from the 52-Ohm target, you now know in what direction the coil must be altered to effect an acceptable match.

Conclusion

Of course, there are many other tuning applications for this instrument besides CB antenna conversions. You will find it more useful than an swr bridge for any application which requires both resonating a load and transforming its impedance. As a bonus, you can use it to measure swr when the load impedance is mostly resistive. The internal dummy load lets you adjust and modify antennas without danger to your transmitter and without putting a big signal on the air. You'll also find that the dummy load and calibrated wattmeter are a valuable QRP tune-up aid. Last, but not least, you can develop a real understanding of transmission-line matching techniques by using the bridge to verify some of the theory you read when studying for your ticket! ■

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Police Freqs for the TR-2400

—a sleepless night for the mod squad

I do not need to extol the bounty of convenience and luxury Kenwood's new TR-2400 hand-held 2-meter transceiver has brought to VHF enthusiasts. Most hams, no doubt, have seen or read of its features—notably 10 channels of programmable memory and its ability to scan these memories, stopping on active or inactive channels. Being strictly a VHF enthusiast, my mind began to drift when my TR-2400 arrived to what the next advance in radio/scanner technology would bring forth. It didn't take very long to imagine the first tri-band programmable hand-held scanner.

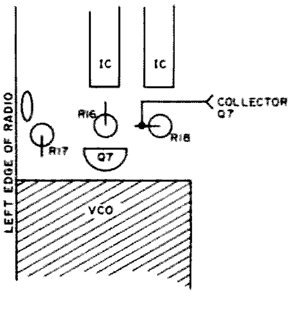

Fig. 1. Vco location.

After all, the TR-2400 had broken the ground, at least in a single-band version.

I also began to ponder the possibilities of converting the TR-2400 to the "action band." One sleepless night was spent tracing the schematic lines and deciphering its method of operation. I would like to thank Trio-Kenwood Corporation for their practice of supplying block diagrams and full schematics with their products. I wish all manufacturers would make it a policy to do the same with every unit. This ham, for one, distrusts "black boxes."

Several possibilities emerged to modify the TR-2400 so that reception in the 154- to 158-MHz range would be possible. Three of them will be outlined here, from simple to complex. The simplest of these is currently working in my rig. The second requires moderate circuit modification, but may not work depending on the range of the vco. The third method requires additional parts and good instruments to adjust, but is sound in theory. I present these here in hope that someone else will follow my theories, try to implement them, and report their results. I cannot because I begin Navy pilot training at Pensacola, Florida, within two weeks of writing this draft and don't have the time!

Theory in Operation

The operation of the TR-2400 is fairly straightforward as frequency synthesizers go. Referring to your owner's manual (pages 14 and 15) with the following description may be helpful, but not necessary, to follow the principle of the synthesizer.

Transistors Q7 and Q8 and associated power supply pass transistors Q2 and Q3, respectively, form a complementary electronic switch—i.e., when Q2 is ON during receive, Q3 is OFF, and vice versa during transmit. Q2 controls the fixed frequency receive beat oscillator/tripler (X1, Q1). Q3 controls the transmit beat oscillator/tripler (X2, Q4). During transmit, positive bias on the base of Q7 causes it to conduct to ground and turn off Q2 and Q8, which turns on Q3 and Q4.

The output of Q4 (138.5 MHz) and the VHF voltage controlled oscillator (vco, Q10) are mixed, filtered, and amplified by Q5 and Q6. This forms a downconverter, much like the i-f system when in a receiver. As shown on the block diagram in the manual, the output of Q6 is always between 5.5 and 9.5 MHz for 2-meter operation (144.0−138.5 = 5.5 MHz). The full range is 5.4 MHz to 9.995 MHz. In receive mode, pass transistor Q2 activates Q1 (127.8 MHz) and D3. The output of Q1 is lower than Q4 by 10.7 MHz, which is the i-f frequency. In order to keep the output of Q6 between 5.5 and 9.5 MHz, the vco must drop its frequency by 10.7 MHz, too. Most of this drop is accomplished by D3 bypassing C27 when forward bi-

ased, effectively *increasing* the value of C26 (the value of two capacitors in series is lower than the smallest value; bypassing one of them therefore increases the value of capacitance in the circuit). This lowers the vco frequency by about 10.7 MHz.

IC Q20 is a binary-encoded 3½-stage decade programmable counter (i.e., it divides by any integer, not just powers of two). Actually, as used here, only 3 decades are programmable: units (A1-D1), tens (A2-D2), and hundreds (A3-D3). The thousands half stage (A4-B4) is wired at one thousand (i.e., A4 goes to Vdd and B4 goes to ground, a binary one). Frequency division of the signal from Q6 is therefore 1000 plus whatever is loaded into Q20 by the microprocessor, Q25 (and interface ICs Q23 and Q24). Divisors range from 1080 at 143.900 MHz to 1999 at 148.495 MHz, the limits of the TR-2400.

The phase comparator reference frequency (5 kHz) is derived from X3 (10.240 MHz) and fixed binary divider IC Q22. To get 5 kHz in this case, a divisor of 2048 is used, which is 2^{11}, hence pin Q11 on the schematic. 10,240 kHz ÷ 2048 = 5 kHz.

The divided outputs from both IC Q22 (reference) and IC Q20 (signal) are fed to IC Q21, the phase comparator. Any difference between phases in the two signals (usually caused by a difference in frequency) causes an error voltage to appear at pin 1, "AMP OUT." This output is proportional in magnitude to the phase difference of the two signals. This error voltage is applied to D2 (actually a varactor diode) to tune the vco frequency and hence correct the phase difference the comparator in IC Q21 senses. Simultaneously, this voltage is fed to four varactors in the front end (D1-4) to ensure peak tuning across the band in the receiver front end. The error voltage was measured at nearly 1/2 volt per megahertz of frequency change.

Back to the beginning for a moment. The transmit/receive switching voltage used to drive Q7 and Q8 is closely associated with the biasing voltage for diodes D9 and D8/D27. These diodes select the routing of the vco output signal to either the receiver (D9) or the transmitter (D8/D27) as it is needed.

To complete the theory of operation, the deviation for transmitting is developed in the vco. Output from microphone amplifier IC Q13 is applied to D5 in the vco, another varactor. Thus, modulation is true FM, produced directly at the VHF frequency without the use of frequency multipliers.

Conversion

The most commonly used portion of the VHF-hi public service band of usual interest lies almost exactly 10 MHz above the 2-meter amateur band (154 to 158 MHz). The transmitter frequency from the vco (143.9 to 148.495 MHz) is an appropriate injection frequency to the receiver for nearly the same range (+10.7 MHz = 154.6 MHz to 159.195 MHz).

The only trick necessary to accomplish this higher injection frequency is to use the higher-frequency transmitter beat oscillator (Q4) with the receiver and turn off the receiver beat oscillator (Q1) and D3. Two wires can be rerouted through the S. TONE switch (if not being used) to shift the receiver up band. No critical or sensitive circuits are disturbed, so performance is virtually ensured.

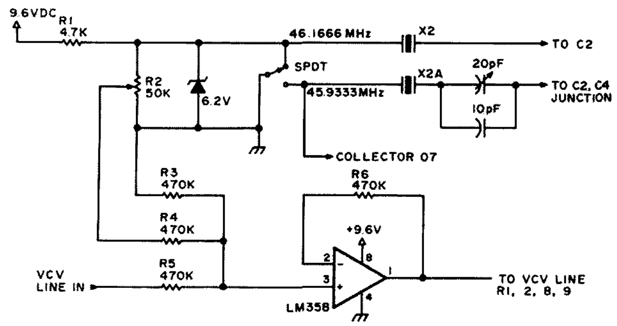

Fig. 2. Suggested circuit. Note: LM358 is a dual op amp in an 8-pin DIP designed for single-ended power supplies.

In operation, the collector of Q7 is bypassed to ground, which switches the oscillators, as needed, but not the radio circuits.

The Mod

Turn the radio off and the TX offset to BU OFF. Remove the four rear screws, back cover, battery cover, battery pack, and the two screws beneath the battery holder. Disconnect the battery. Locate the empty area in the center of the rear circuit board where the tone board would go. Find the red (V+) and black (ground) wires and short them together (use a piece of insulated wire if you like). The red line will be disconnected from V+ in a moment. Replace the back cover without screws.

Turn the radio over, face up. Carefully lift the face plate up and off to the right. All these ICs are CMOS and could possibly be destroyed by static charges on loose fingers or tools. There is no need to touch these, so *don't!* Note: You will be on a remote lead of the microprocessor (PA2), but this lead has static protection (C9, R66).

Find the S. TONE switch assembly in the top, center. Just to the right of this switch is a black wire marked B1. Follow this wire down to the bottom edge of the board. Remove this one end of the wire from this point by cutting or unsoldering it. This disconnects the red wire on the bottom board from V+. Lay the black wire aside.

In the lower left corner is a shielded portion of the circuit. This is the vco. At the top of this box is transistor Q7 and its associated resistors. To the right, in the 2 o'clock position, is R18. See Fig. 1. The wire lead of R18 is the connection point for the end of the black wire removed above. The lead on R18 has a ceramic coating for insulation, part of which must be removed to make a place to solder the black wire. This coating will chip away easily under a pen knife, razor blade, or even serrated plier tips if done very gently. After removing the insulation, solder the black wire to the resistor lead quickly. These small resistors won't handle much heat for long. Don't break the circuit. This is just a convenient attachment point.

That is the entire modification. Put the case together, careful not to pinch any wires, and connect the battery pack. Be careful not to overtighten the screws. Turn the radio on before moving the TX OFFSET switch from BU OFF.

Operation

This modification causes the ON AIR indicator to be on when the S. TONE switch is depressed. The transmitter is *not* on. The microprocessor (pin PA2) reads the collector of Q7, which you just shorted to ground, as the transmitter.


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Only the transmit beat oscillator is on. While in this mode, I suggest you keep the F LOCK *ON* and the TX switch in the STOP position to avoid inadvertent transmission while monitoring. If you do transmit, the transmission will be in the amateur band as usual.The transmitter is *not* shifted up band by this modification.

To receive the desired new channel, subtract 10.7 MHz from the known frequency (e.g., 155.61 MHz − 10.7 = 144.91). Make sure the S. TONE is off (up position) and program the radio as usual for the corrected frequency (e.g., 4.910). Now depress the S. TONE switch. As the ON AIR flag appears, your radio is tuned to the new channel.

While in this mode, the keyboard will not function, just as if you were transmitting; thus, there is no band scan or memory scanning. These features may be regained by the more complex modifications, or by isolating pin PA2 of the microprocessor and keeping it near Vcc (which I do not recommend). If the radio is turned on with the S. TONE switch already depressed, an incorrect display is likely to occur. Simply turn the S. TONE switch *off*, then *on* again to correct the readout. Receiver sensitivity in the new band will fall off because varactors D1-D4 (front end) are not being properly tuned for this higher range. However, sensitivity remained sufficient to receive my local sheriff's department near the edge of the county.

Other Theories

The best theory requires some careful circuit work, but has great promise. Basically, if you add 2000 to the divisor at IC Q20, all frequencies would be shifted up by exactly 10.0 MHz. This is easily done by lifting B4 from ground and connecting it to Vdd, or A4. Thus, programming would be just as on 2 meters—just the last 4 digits of the frequency, without the need for a correction factor. Using this higher divisor would allow using the receive beat oscillator and keep band and memory scan capability.

The easiest way to keep the vco working 10 MHz higher than usual above the receive beat oscillator is to isolate D3 in the vco by breaking the control line from Q2. An additional switch would be needed to switch it back in for normal two-meter operation.

A more extensive circuit addition may yield better results. The AMP OUT line from IC Q21 goes from about 1.2 volts to 3.4 volts (a range of 2.2 volts) from 143.9 MHz to 148.5 MHz (a spread of 4.6 MHz), or roughly +.5 volts/MHz. Thus, to go 10 MHz higher would require about 5 volts more, in addition to 3.4 volts, for a maximum swing of 8.4 volts. This is below the battery voltage and is therefore feasible, but may not be practical. There are several limiting factors that must be checked before implementing either modification: 1. capacitance range and response curve of D2 for these voltages; 2. maintaining the supply voltage; and 3. will IC Q20 handle an input frequency of 20 MHz?

The output of the AMP OUT line of IC Q21 is limited to Vdd, the supply voltage from regulator Q9. This is 6 volts, or about 10 MHz of total possible spread, using 1 volt as a minimum figure and linear mode of operation from D2. One possible solution to this limited voltage swing is an amplifier stage with a voltage gain of 2 connected to the battery line. The output would feed varactors D2 and D1-D4 in the front end. This may tune not only the vco over the full 15 MHz, but also the front end to maintain sensitivity. However, it may be impractical to use the unregulated battery voltage. Low batteries and varying load conditions (e.g., audio) may cause voltage fluctuations and instability in the vco.

Still one more option exists. Alternating X2 with a crystal for 45.9333 MHz would shift the transmit beat oscillator exactly 10.0 MHz above the receiver oscillator instead of 10.7 MHz. These crystals would be switched in or out by means of their ground connection. These two crystals (X2 and X2A) would differ by less than 250 kHz, so the bandwidth of the oscillator should not be a problem. The accurate tuning of these crystals is imperative. To tune the front end, an op amp could be used in a voltage summing circuit. (See the suggested circuit in Fig. 2.)

The trimpot would be adjusted to add a preset value to the vcv (varactor control voltage) line to feed the front end (only) when switched in. When not in use, both sides of the pot would be grounded so it would add zero volts for normal operation. Note: X2A may also work on the receive oscillator side if Q1 is broadband enough, and D2 will work on a higher voltage. If so, change R3, 4, and 5 (Fig. 2) to 220k and connect the vcv line to D2 as well. Eliminate the connection to Q7. This will restore memory scan again.

It is my hope that someone else will pick up on these ideas and work them out to completion. In emergencies, such capability to switch between ham and police or fire department channels could prove very valuable.

Good monitoring! ■

Jim Gray W1XU
73 Magazine Staff

Those Amazing Bobtails

—the current-fed connection

The Bobtail antenna system described in the references has created quite a stir. Various combinations of construction methods and feed systems have been suggested through a great deal of correspondence between various amateurs.

A nagging problem has been the lack of a satisfactory explanation of the operation of the antenna when it is current fed. It is hoped that this article may shed some light on this subject and spur others on to try this excellent antenna.

To begin, we need a couple of definitions: 1) Voltage feed—feeding an antenna at a point where a voltage loop (or maximum) occurs. 2) Current feed—feeding an antenna at a point where a current loop occurs.

Antenna theory shows that whenever you have two vertical radiating elements spaced 1/2 wavelength apart, the radiation will be reinforced in a direction perpendicular to a line drawn between the antennas. By using three vertical radiating elements (or four, five, or more) all spaced 1/2 wavelength apart, the radiation will be reinforced in the same directions as before, approximately proportionally to the number of radiating elements. Such an antenna is known as a curtain. Because our antenna has only three elements, it is known as a short, or Bobtail, curtain.

Curtain antennas of the type described are bidirectional, with radiation patterns that look like elongated figure-eights viewed from the top of the antenna looking down. The figure-eight pattern extends perpendicularly from a line drawn between the antennas, and when many elements are phased, the figure becomes longer and skinnier and the result is a bidirectional beam: a *broadside array*.

In order to understand the operation of the Bobtail curtain antenna, one must consider the antenna currents in terms of their magnitude and phase relationship. Ideally, in an antenna of this type, all radiation is from the vertical elements, and little or no radiation occurs from the horizontal sections (flat-top portion) because these exist merely to achieve the proper phase relationship between the vertical elements.

Heretofore, the Bobtail has been *voltage* fed by means of a coupling network attached to the bottom of the center element, although it is possible, if desired, to attach the coupling network to the bottoms of either of the vertical end elements.

For many reasons, including convenience, ease of matching, simplicity, elimination of coupling networks, and other factors, it has been considered desirable to find another way of feeding the Bobtail, and such a method has been reported as having been used with success by a number of different amateurs. Here's how it works:

In Fig. 1 observe that the Bobtail array, as before, consists of the three quarter-wave vertical elements at A, B, and C. The two end elements at A and C are essentially a portion of the flat-top and connected directly thereto.

The center vertical element is separated from the horizontal flat-top portion by a small insulator at G, and the conductors of a coaxial feedline are attached to the flat-top and to the vertical element, across the insulator, with the center conductor connected to the vertical, and the braid connected to the exact center of the flat-top, at B.

Vertical element A is separated by 1/2 wavelength from element B, and vertical element B is separated by 1/2 wavelength from vertical element C. Flat-top sections A-B and B-C act as phasing lines to make the current relationships in the antenna come out properly, i.e., the current in section A-B is 180° out of phase with the current in B-C, and therefore they cancel.

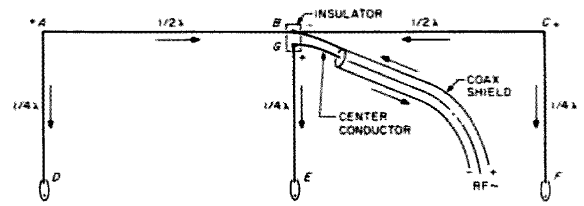

Fig. 1. The current-fed Bobtail.

The currents in the vertical elements are in phase and add because the current is traveling in the same direction at any given instant (but the currents are not equal in magnitude). The reason for this is that the vertical elements are each only 1/4 wavelength at the operating frequency. The current divides between the vertical elements in a ratio of two to one.

In order to satisfy the phase requirements, the magnitude of the current in the end elements must equal the magnitude of the current in the center element. Since there are two end elements and only a single center element, the current in the center element must be twice that in each of the end elements.

If you study Fig. 1, you will notice that for a particular given half-cycle, the + and − signs are as shown, changing sign at each 1/2-wave point. We have assumed the feedline to be exactly 1/2-wavelength long. The arrows between the plus and minus signs show the direction of current during the particular half-cycle we've chosen to illustrate. During the next half cycle, note that the polarity at each of the half-wave points will change and the current arrows will reverse direction, but also note that, once again, the currents in flat-top sections A-B and B-C will cancel. The currents in the vertical elements will again add in-phase in spite of the fact that their direction is reversed. Thus, on each half of every full cycle the vertical elements always add in-phase and the flat-top sections always cancel.

Interesting Side Notes

If you turn a current-fed Bobtail upside down, it looks like a much more familiar antenna system. By eliminating the phasing line (flat-top) and substituting ground, you have three 1/4-wave verticals spaced a 1/2-wave apart. This is very common practice in antenna systems, for example, in the broadcast industry for directional beaming.

The disadvantage of all but perfect ground systems is the resistance loss in imperfect conductors. Consider, now, what happens when we use the Bobtail array: The "ground" becomes the horizontal wire or flat-top—nearly loss-free compared to ordinary ground and, better still, elevated above earth by at least a 1/4 wave.

What this means is that the antenna becomes more efficient and the radiating portion is raised. The high-current portion of an antenna is the portion which does the biggest share of the radiating and that is why it is best to get it as high and as in the clear as possible. The Bobtail array accomplishes these things and, therefore, is a good antenna compared to one in which the radiating portion is low and the losses in ground resistance are high.

One more item. Radiation from a Bobtail is *vertically* polarized and therefore, when placed as in the configuration shown in Fig. 1, exhibits not only gain, but a very low angle of "take-off," as is typical of many vertical radiators. Hence, it's a good DX antenna.■

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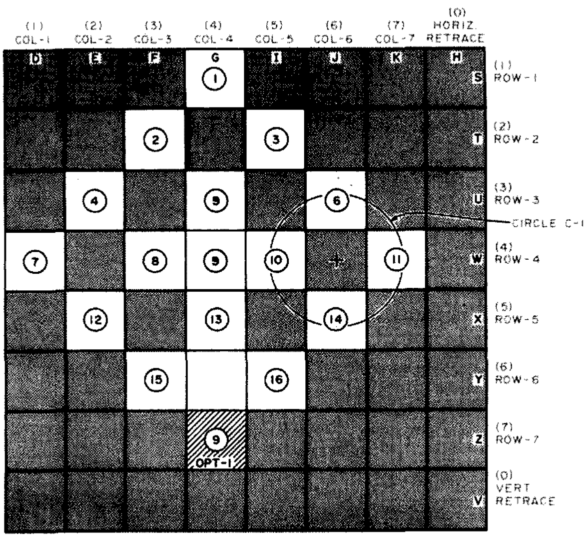

Fig. 1. Video monitor screen presentation. White squares with numbers are the maximum number of squares that can be lit. Dark areas are never lit. One possible moon image is shown by circle C-1. This would light squares 6, 10, 11, and 14. Adjust your lens or lenses for approximately this kind of spot size. The numbers correspond to the LDRs in Fig. 10.

Is your OSCAR or EME array all automated for tracking? Mine is, but I still wanted a means of visually tracking in a manual mode. This article details the simple "moon" camera I came up with to look at the moon while I stayed comfortably in my basement (Indiana winters get cold!). It also makes a fine motion detector or low-resolution surveillance camera.

Take a look at Fig. 1 for a moment. What I have is the screen of a TV set or, in my case, a video monitor. There is no reason why you can't feed the video output of my simple camera to one of the TV game modulators and pipe it into any TV set as rf on whatever channel the game modulator outputs on.

As shown, the spot or image of the moon has been concentrated into a round circle that just illuminates one or more of the photosensitive devices (more on them later). Whenever light shines on these devices, their resistance is greatly lowered and I sense that change to light a square on the monitor screen. In order to have the different positions on the screen represent different aiming positions of the antennas, there are two main requirements.

The first and easiest is that the camera be physically boresighted to the antenna. That's just a fancy way to say that it has to be aligned to look where the antenna is looking.

Secondly, the photo devices must be arranged in an array that duplicates

what you want to see on the screen and then scanned in step with the monitor scanning. These last two requirements are met easily using the circuitry and board layouts provided by this article.

Since I have started you out at the photo-sensing end, let's begin there on the circuitry and boards. The first thing you will notice is all the boards are round instead of square or rectangular. This allows for mounting in a round enclosure (details later, under Mechanical Assembly). The first board to consider is the LDR Board, shown in Figs. 2 and 4. I used light-dependent resistors (LDRs) as photo devices; mine are about ¼" in diameter at the light-input end. This allows the array of 16 LDRs you see the pattern for to fit easily on my round board.

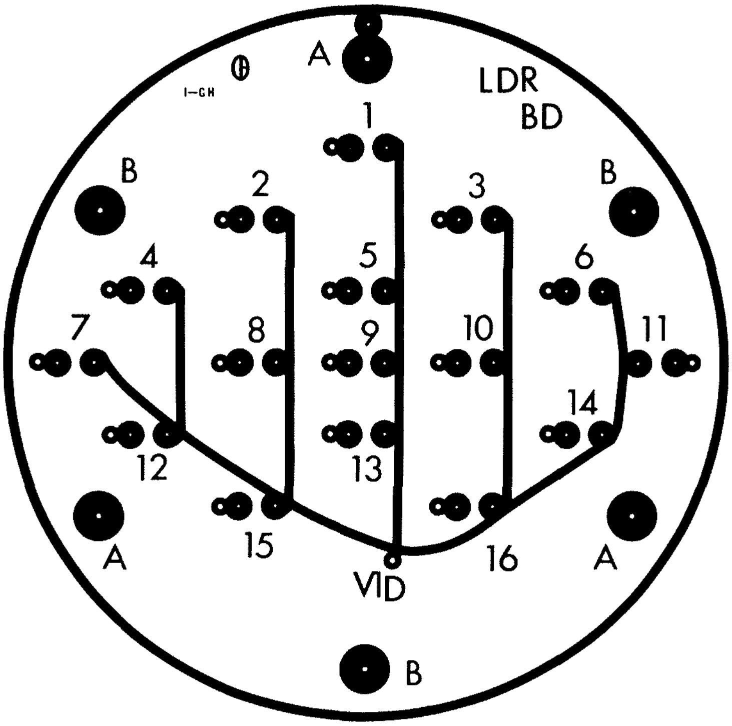

Fig. 2. Foil side of LDR board.

To mount the LDRs in the board, you need sockets of some kind. This avoids direct soldering and the possible altering of the resistive characteristics of the LDR. I highly recommend an item called a matrix pin by AMP, Inc.; it is their part number 380598-2. These are single-terminal push-in sockets and are sold by many parts houses and the magazine advertisers. Just drill out the circles to hold the sockets of your choice and load the board up as shown.

All leads come to the board from the copper side and pass through their holes, leaving a small amount of the stripped lead on the copper side to solder to. When this board is complete, there should be seventeen leads 4" to 5" long coming off the copper side. (Use different colors to avoid confusion.) 16 leads are to one side of each LDR, and one lead is common to all LDRs and is called the video lead (VID). There is really no easy way to test the board at this point, so set it aside and go to the counter chain schematic in Fig. 3. The corresponding foil and component sides are shown in Figs. 5 and 6.

The counter chain should go together quickly, and it can be checked out fully when completed—less any other boards. Load the board as shown and then check the test points using a frequency counter or oscilloscope at each test point against Table 1. The starting point is at the 555 IC, as this is the master clock. It should *run* at 122.88 kHz, and you adjust to that using the PC board thumbwheel pot, Ra. The set you use for a monitor will more than likely lock up (have steady sync) if the clock is from 122.0 to 123.5 kHz, but you may have something called flutter due to a difference between your divided-down vertical (59.57 to 60.3 Hz in the clock range just given) and the proper 60-Hz rate used to avoid beats against the power line 60 Hz.

The wide range of tolerance on most TV sets allows you a lot of leeway

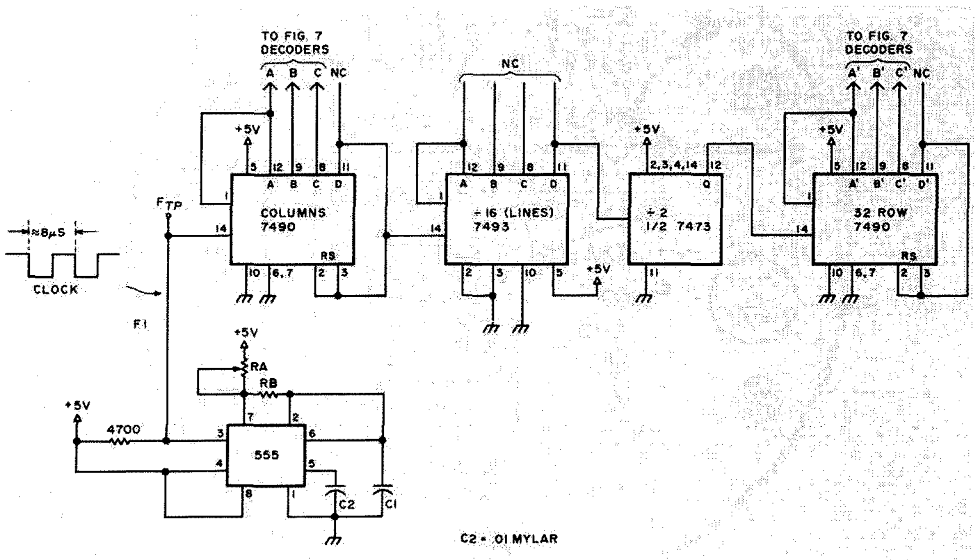

Fig. 3. Counter chain. Set for a frequency of 125 to 126 kHz at F_{TP} test point. For this application, C1 = 220 pF, Ra = 10k thumbwheel PC pot, Rb = 18k, ¼-W fixed resistor. General formula is: f = 1/T = (1.44)/Ra + 2Rb) × C.

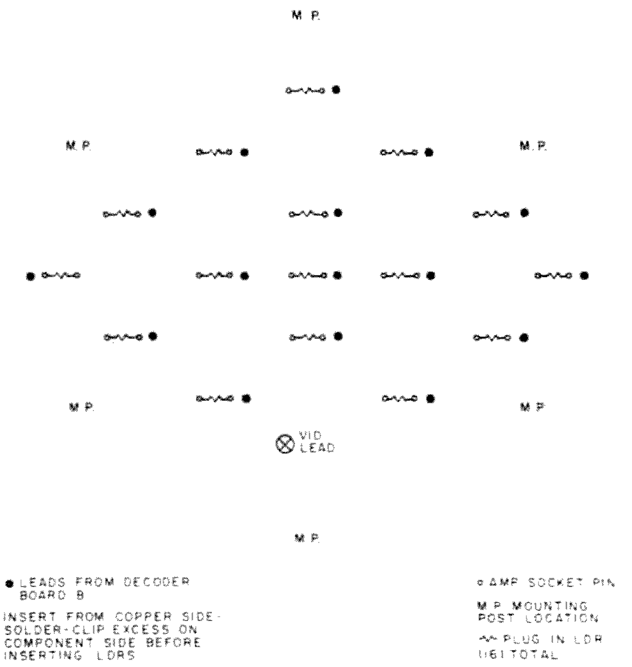

Fig. 4. Component side of LDR board. M.P. designates mounting post (threaded spacer) locations. Use alternate locations between any board pair, thus only three spacers looking like a triangle between any board pair. Small circles are socket pins for LDRs. Solid dots are leads from decoder board B and should be inserted and soldered from the copper side and excess lead on component side clipped off flush with board. Resistor symbols are LDR locations.

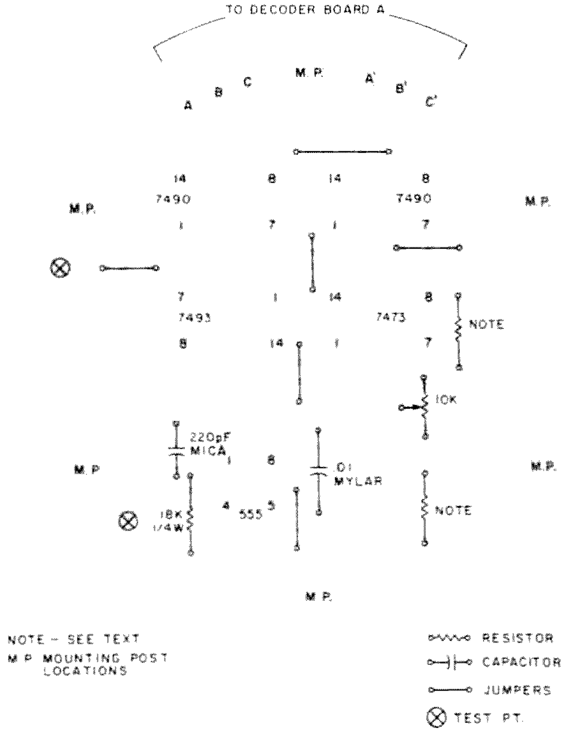

Fig. 6. Component side of counter chain board. Standard schematic symbols are used to show component mounting locations. Solid lines connecting dots indicate jumper leads. Circled x indicates test point.

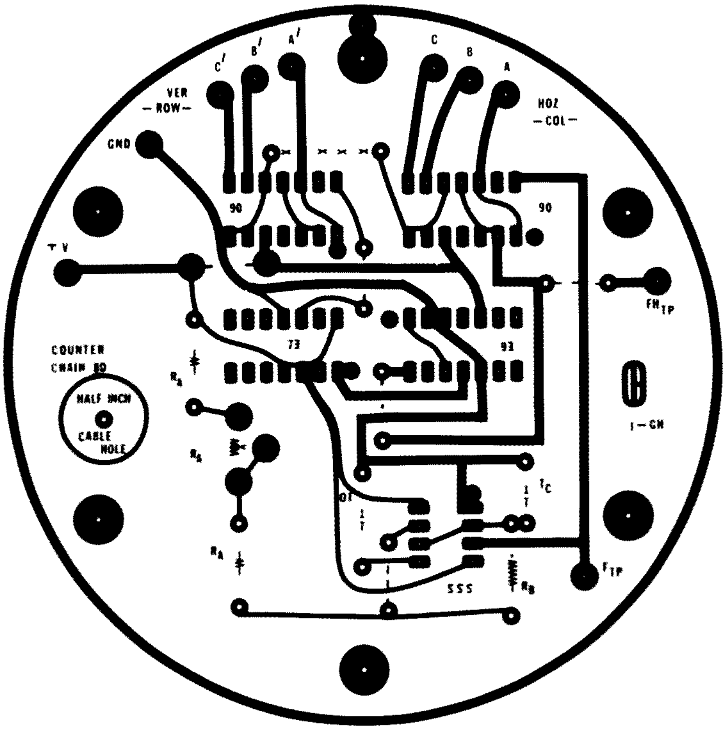

Fig. 5. Foil side of counter chain board.

in the setting of Ra where the set will lock up and look alright. If you can't get things as good as you want using a 10k pot for Ra and jumpers in the fixed Ra positions, a smaller pot can be used along with fixed resistor(s) to allow Ra to effectively tune slower. You would have to find the two extremes of Ra settings that create a locked-up picture, measure the resistance of Ra in each case, and use the difference as the new Ra value. Then fixed resistors make up the jumpers. Remember, the total must be 10k.

Example: If the set locked up alright on resistor Ra settings of 2500 Ohms to 7500 Ohms, use a new Ra of 5k and one fixed resistor of 2500 Ohms in either fixed Ra (jumper) position. Your new range then becomes 2500 to 7500 Ohms.

Ignoring the +V and ground leads needed by all boards except the LDR board, there are only six leads leaving the counter chain board (A, B, C, A', B', C'), and they all go to the points lettered the same on

decoder board A (Fig. 7). If these points are outputting according to Table 1, the 7442 decoders (IC1, IC2) will decode the BCD line codes into one of ten outputs. Since the D line is not used off the 7490s, the 7442 becomes a one-of-eight decoder. In IC1, positions 1 to 7 represent seven vertical columns across your monitor screen. Position 0 is left as horizontal retrace and is covered on the video/sync board. IC1 runs the sequence of 1 to 7, then 0, 32 times before any change occurs in the vertical scan decoder. This means 32 lines that are identical in vertical coding across the screen. This is accomplished by placing a fixed divide-by-32 chain between the horizontal and vertical counters.

In the case of the number 1 LDR, if light is shining on it each of the 32 lines will go white from a black screen as it scans over the column position 4 (center). When this happens 3 times, a white square is formed at the top center of your screen. When you have all your camera boards together but no optics or lenses over the LDRs, the monitor screen will light white squares in the same pattern as the LDRs are laid out on the board if

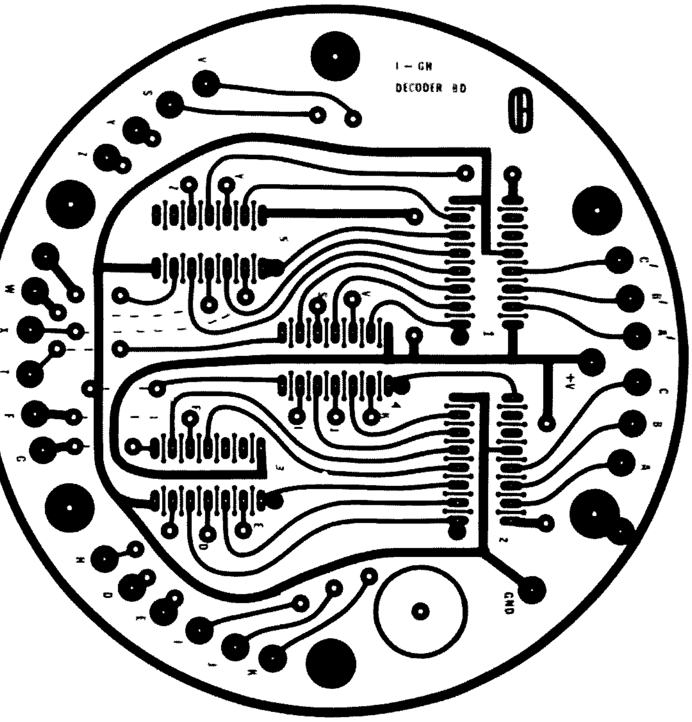

Fig. 8. Foil side of decoder board A.

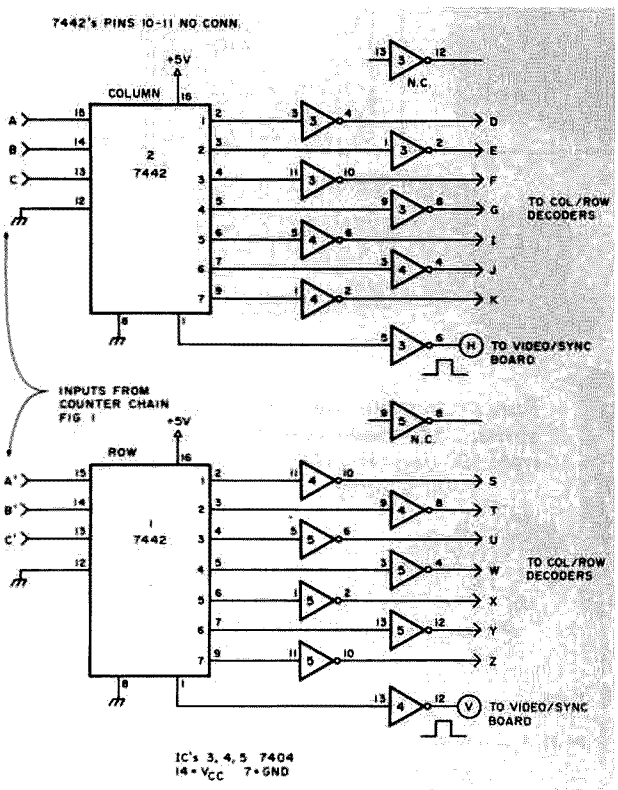

Fig. 7. Schematic of decoder board A.

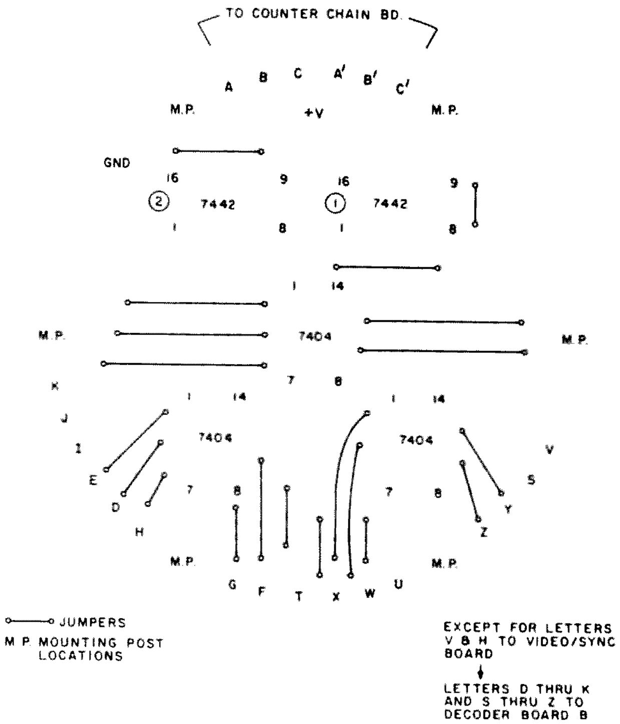

Fig. 9. Component side of decoder board A. Letters V and H are leads to video/sync board. Letters D to K and S to Z are leads to decoder board B (except V and H). Solid lines connecting dots are jumpers on component side.

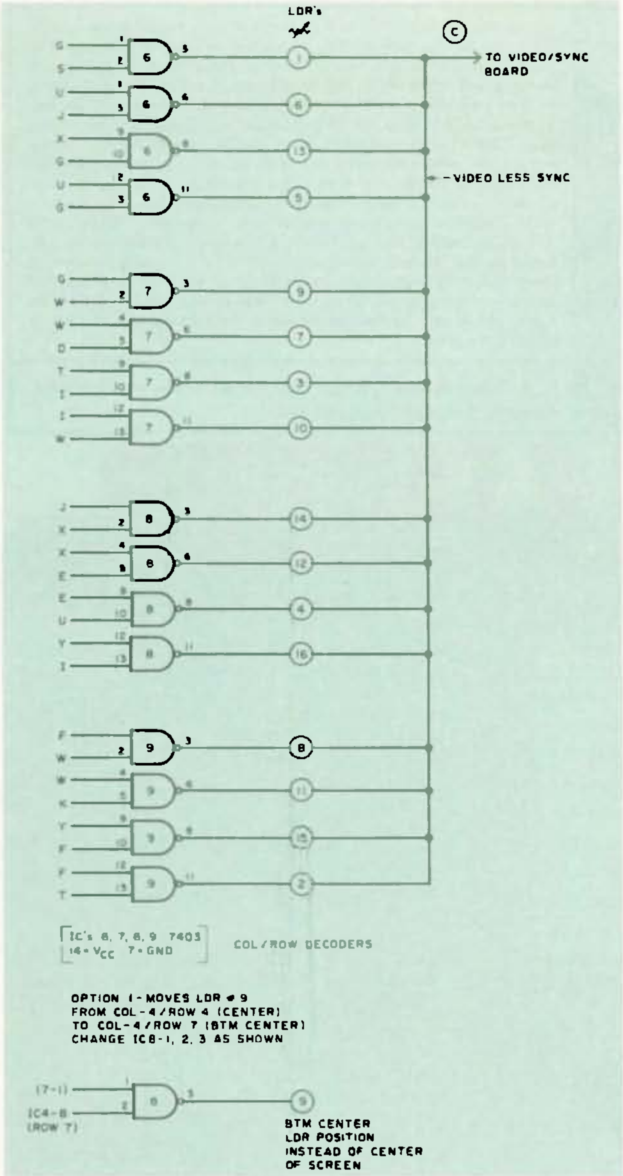

Fig. 10. Schematic of decoder board B. Option 1 moves LDR #9 from column 4/row 4 (center) to column 4/row 7 (bottom center). Change IC8 pins 1, 2, and 3 as shown, and load LDR at bottom center.

light is falling on all the LDRs. This will be a final check that all is working, before the mechanical assembly.

The row decoder (IC2) does the same job as the column divider (IC1) but at a slower rate, to handle horizontal rows. Therefore, it advances one position after each 32 horizontal lines. This happens seven times, forming 7 horizontal rows of 32 lines each. If more LDRs and decoding were used, the camera has a possible 7 × 7 or 49-position resolution. The complexity is not worth it, and the camera functions just fine using only 16 of these 49 possible locations. This is accomplished by allowing the focused moon image to be larger than one square of resolution and using multiple lit boxes to show where the image is relative to center screen (on target). A perfectly aimed antenna will produce a white + sign at the center of the monitor screen.

IC3, IC4, and IC5 are merely inverters to get the low 1-of-8 outputs of the 7442s back to highs that can be gated together in further TTL logic. Figs. 8 and 9 show the foil and component sides of decoder board A.

The last of the decoding occurs in Fig. 10, decoder board B, where 7403 gates are used to detect which of the 49 squares the monitor is scanning over and enable the proper LDR for that segment. Figs. 11 and 12 show the foil and component sides of decoder board B.

For the positions that have no LDRs, as you will see more clearly next on the video/sync board, there will be no LDR enabled and the video (VID) line will be at or very near +V. This +V on the VID line will represent a black screen on the monitor in the final video composite. For those squares that have an LDR sensor, each has a corresponding 7403 gate section. When the gate is enabled, the open collector output tries to pull +V down to ground through a load resistor. All the LDRs are in parallel by the video line, but only one at a time can be considered in the circuit—the one enabled by the scanning chain.

Going briefly to point C on Fig. 13, the video/sync board, you will see a 10k resistor to +V in the base circuit of the first video stage. The circuit is really a voltage divider consisting of that 10k at all times, in series with either (1) an LDR that is in series with the output transistor of its 7403 gate to ground, or (2) the 10k alone with no enabled LDR for those positions not having LDRs.

Remember, I said +V on the VID line meant a black screen. Automatically, you have 33 positions representing no LDRs and a black screen. In the 16 positions having LDRs, the LDR represents the lower resistor in a voltage divider and as such will cause the voltage at point C to be very close to +V (LDR off—no light), or very close to ground (LDR on—light shining on it). My LDRs swing from several megohms (dark) to about 400 Ohms (light). That means the voltage divider changes from (1) +V through 10k through megohms to ground, causing the junction of the 10k and LDR to be very close to +V, to (2) a series of +V through 10k through 400 Ohms, causing the junction of the 10k and LDR to be very close to ground. This junction voltage controls the base of the first video stage.

Following through the video for an example of one LDR with light on it, the VID line and point C will be low or near ground. The first video stage is just an emitter follower, so no inversion occurs and the base of the second video also will be low and the transistor at or near cutoff. When it is cutoff, the collector rises to at or near +V, and this represents white on the screen.

The last stage is also just an emitter follower to allow enough current to drive a 75-Ohm cable and the 75-Ohm load presented by either the game modulator or the video monitor input. If the monitor has a gain or video drive control, jumper A to C in the last video emitter circuit and omit the onboard gain pot, RL. If the monitor has no control or the game modulator no input gain adjust, use RL and jumper B to C to allow some means of adjusting overall composite video level.

The base of the final video stage has control from two more points that should be covered here. The two transistors with H and V for inputs are the sync mixer and make up the

final composite video. Each time the H line goes high (every horizontal line, position 0) or the V line goes high (every vertical scan or field, position 0), the base of the final video is dropped to approximately 0.2 volts, or close enough to be called ground. This is sync-voltage output in my camera.

If the video example were reversed, using a dark or absent LDR position, the second video stage can turn on only to the point where its collector is at 1.4 volts. This is caused by the two diodes in its emitter for 0.6 volts apiece and the 0.2 volts from emitter to collector on the second stage. This 1.4 volts becomes our black level, and allows for the normal video composite of sync being blacker than black. If you consider my composite video as 0.2-volts sync, 1.4 volts-black, and 5.0-volts white, then divide it down with the level control, you will end up with video composite of very close to the standard of 1.0-volt video, 0.4-volts sync. It at least seems to be close enough for a perfect picture with stable sync, and I felt that trying to get any closer was not worth the time or extra components. Foil and component layouts for the video/sync board are shown in Figs. 14 and 15.

That about completes the electronics package, and if you have a power problem, the 74Cxx equivalents can be used for all the TTL devices except the final 7403 decoders. The 555 is running well below its maximum +18 volts, but seems content and quite stable on +5 volts.

Mechanical Assembly

The area of mechanical assembly will vary, as with most ham projects, along with its uses. For that reason, I'll outline how I did mine and you can carry on or modify from there. As illustrated in Fig. 16, the housing on my camera is PVC plastic pipe! That's why all the boards are round and separated by three spacers between each board. You can, thereby, build up a board-over-board sandwich by skipping every other hole of the six given per board to set the spacers on.

Looking straight into the LDR board, it is spaced from the board below it by 3 spacers in a triangle. The next board below, by 3 in an inverted triangle, and so on. I used 4-inch i.d. black pipe, and would suggest that whatever you use be black inside to avoid light reflections and stray light. You can buy end caps for the pipe, and I used one as is on the rear of the camera. It was stuck on with rubber cement for easy removal. One hole in this cover allowed the RG-59 feedline to exit through, and a second would have to be provided if the on-board level control is used—I did not use it.

The front cover I made from another end cap, but I sawed off the entire lip from the horizontal center line down. This allowed me to add small aluminum brackets to one side. To the

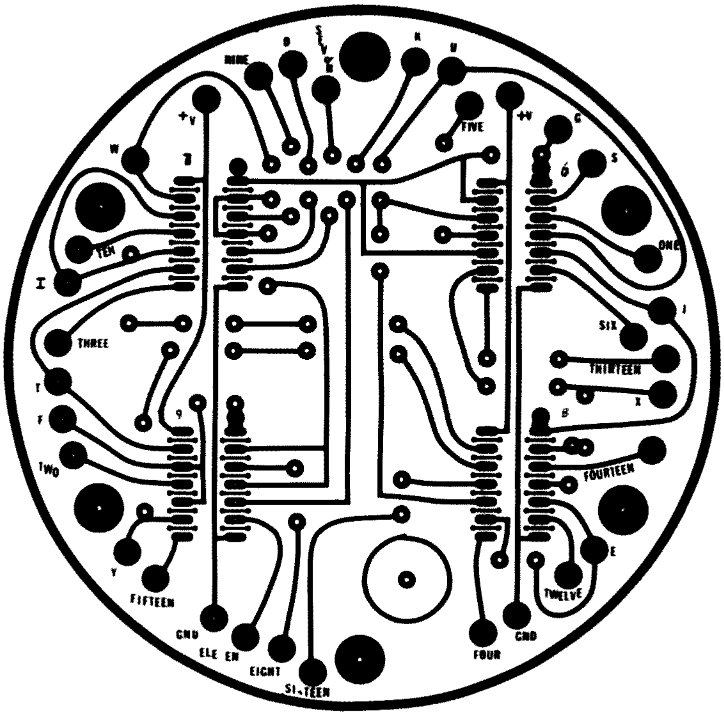

Fig. 11. Foil side of decoder board B.

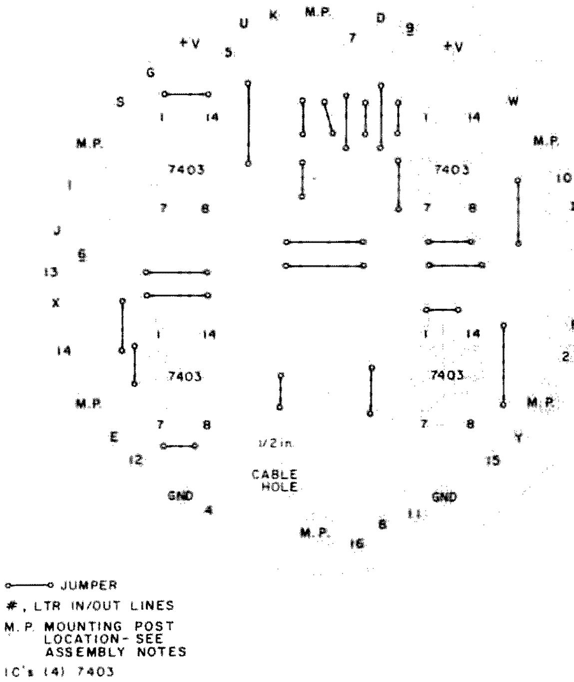

Fig. 12. Component side of decoder board B. Numbers and letters indicate proper placement of input/output leads to other boards. Solid lines connecting dots are jumper leads on component side.

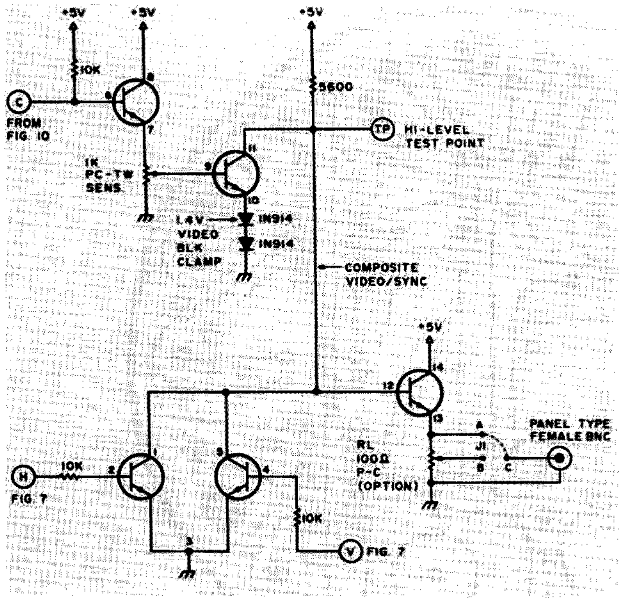

Fig. 13. Schematic of video/sync board. All transistor devices shown are small-signal NPN devices in an RCA IC, CA3046. Numbers shown around the e-b-c of devices indicate pin numbers of that IC for reference and troubleshooting. Note: If cable is terminated in 75 Ohms at the monitor or a drive-level pot (usually 50 to 100 Ohms in monitors), use J1 from A to C and omit pot RL. If no drive level is used on your monitor, jumper B to C and use RL as your drive control to prevent overload.

bracket is attached a rod that runs down the side toward the rear to a small, sealed, metal box that holds a 4-rpm dc motor I had lying around. It is much like the ones the advertising signs use, and I think it was for 6-V dc battery operation. Plus 5 volts runs it just fine, if a bit slow. This allows me to remotely rotate a "lens cover" of sorts on and off the end of the pipe to keep rain, snow, dirt, etc., out of the lens area.

On the topic of lenses, or optics, I am still trying for a better setup, but one of my prime criteria was that it be cheap. After all, I'm trying to avoid using an SSTV or FSTV monitor camera because of cost, so why use a camera lens that costs more than the system electronics? So far, the best combination I have found is with dime-store magnifying glasses with their handles removed.

I fixed-mounted one that was right at 4 inches o.d. at the center of a 6-foot piece of PCV pipe, and that allows me to slide the electronics in and out towards it from the rear. I also have a 3.5-inch lens mounted in a 4-inch collar that I can slide in and out from the front of the pipe to form a compound lens system. That is the area of experimentation at the moment, and I don't mind admitting my physics classes were too long ago. Optics was never really my bag, nor was photography, so all help offered will be gratefully accepted.

The limitation of this system would seem to be use only during full moonlight, but that depends on the response of the photo device you use and the lens system you end up with. As it stands now, I can track in some very hazy conditions, and even clouds don't confuse things too much. Next to try is a full-blown infrared system, I think!

For all the OSCAR fans who read on when the name was mentioned in paragraph one, I have not gone bananas enough to try visually tracking an OSCAR satellite with the LDR system. However, the same electronics system is being tried, mounted in the same waterproof-type housing with two full caps. The difference is that the 7403 outputs will be used to activate PIN diodes (or similar switching devices) on the downlink antenna system. I am trying to build onto the outdoor, steerable OSCAR antennas something like my Twinlead Terror antenna system (*73 Magazine*, November, 1977, p. 54), and then do the video add-on at the monitor end using the sync/white commands coming down the 75-Ohm cable. The video then would be derived from some form of the receiver agc. I mentioned this earlier, in the Twinlead Terror article (which got titled, "Cheap Ears for OSCAR").

You can do some positively wild things with scanned and electronically-steered antennas when you have only receiver power levels to worry about. It becomes even easier when you have a full-duplex, two-band arrangement like the OSCAR uplink/downlink. The receive antennas scan at a high enough rate to be above audio, so you can easily filter out the switch-rate whine. All you hear is the additive result, but each antenna's agc product is

Signal	Location	Measured Frequency	
1. F_{tp}	555 IC pin 3	122.880 kHz	(for H = 15,360 Hz, V = 60 Hz)
2. A	Column IC pin 12	61.440 kHz	
3. B	Column IC pin 9	30.720 kHz	
4. C	Column IC pin 8	15.360 kHz	
5. D	÷ by IC pin 11	960 Hz	
6. Q	÷ by IC pin 12	480 Hz	
7. A'	Row IC pin 12	240 Hz	
8. B'	Row IC pin 9	120 Hz	
9. C'	Row IC pin 8	60 Hz	

This has the horizontal sync running about 400 Hz low, but allows the vertical sync to be correct to avoid vertical "flutter." This is a compromise to reduce system electronics, but all sets tried pulled in easily to the lower horizontal rate. The following is a representation of the VID line with light shining on all LDRs. L is TTL low pulses. Scope Horz. rate = 1/60 sec per full horizontal scan or about 3 ms per cm on a 6-cm Horz. scale.

HHHLHHHSHHLHLHHSHLHLHLHSLHLLLHLSHLHLHLHSHHLHLHHSHHHOHHHS

H is TTL high, S is sync (app. 0.2 volts), O is option LDR 9

Table 1.

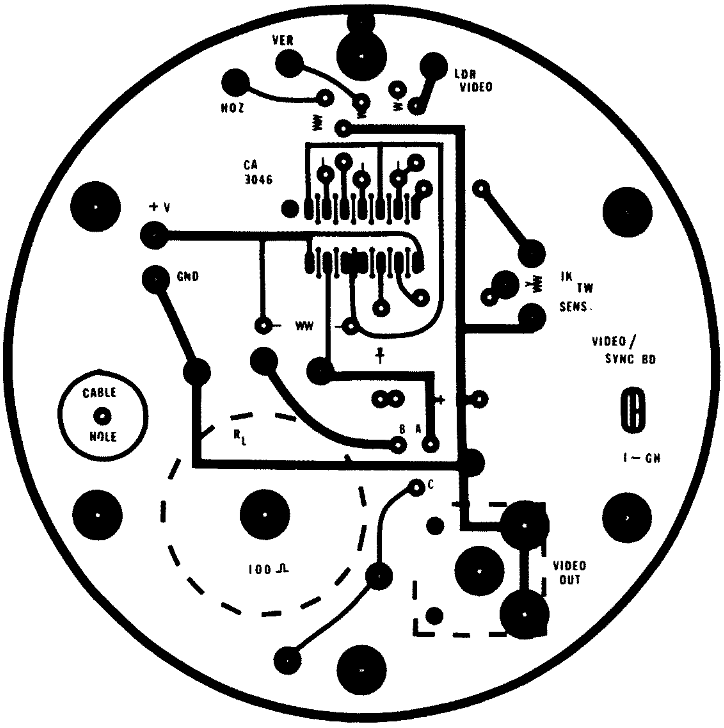

Fig. 14. Foil side of video/sync board.

sampled, and only the highest is used to light the white box on the monitor—sort of a sample, hold, choose-the-highest-figure, and use-for-display system.

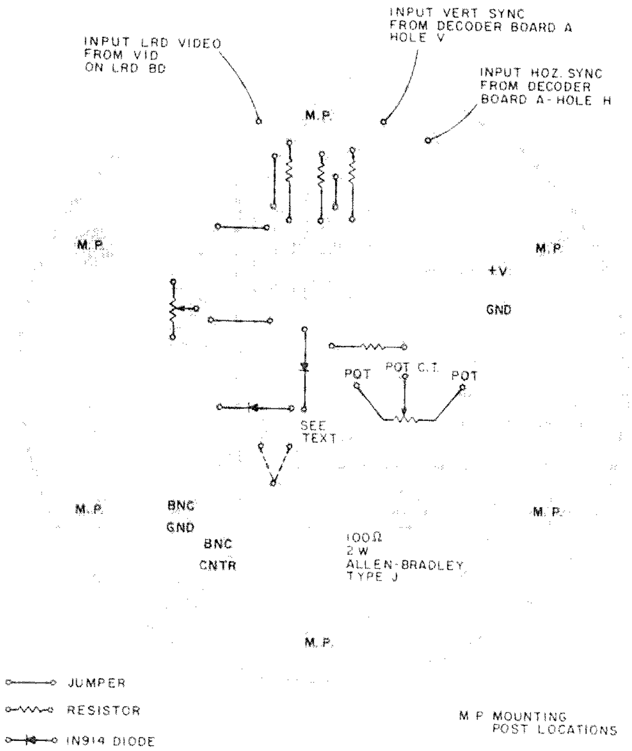

Fig. 15. Component side of video/sync board. Schematic type symbols are used to show loading placement of components. Solid lines connecting dots are jumpers on component side.

I am still deciding whether to use steer antennas to produce center-box white scheme, or sample and display all levels as boxes in the same arrangement in which the antennas are mechanically set up. The latter has the advantage of being able to tell what polarity sense the signal really is, at the antennas, by observing what box(es) are lit the brightest, and to what polarity you have those antennas aligned. It does require small changes in the video stage of the camera, however, so you don't get just saturated white or black off positions intentionally chosen for the EME arrangement.

I have tried several sample-and-hold circuits and antenna positionings so far and have found none to be the perfect result I want. Many such circuits are already around as described in the articles over the past couple of years and 10-meter antennas are easy to build, so you may have your system running before I have mine complete. I am working hard on the EME version at the moment, but should get back on the OSCAR version soon.

The cost of the A-to-D converter IC is quite attractive now, and with my love for digital circuits I am going to try one more sample-and-hold circuit using that type of device. It is an analog in, 3 digits in BCD output device covered a bit further as an antenna readout device for use with CDE Ham 3 rotator controls in *Ham Radio,* January, 1979, p. 56. The device used there is an AD 2020 by Analog Devices, Norwood, Massachusetts.

If there are any questions, please include an SASE, and I'll sure try to help you. If you come up with other uses (surveillance, etc.), please write, as several people have already approached me with ideas beyond what I had in mind. I'll try to act as a go-between as best I can for any new ideas for my camera. Good lookin'.■

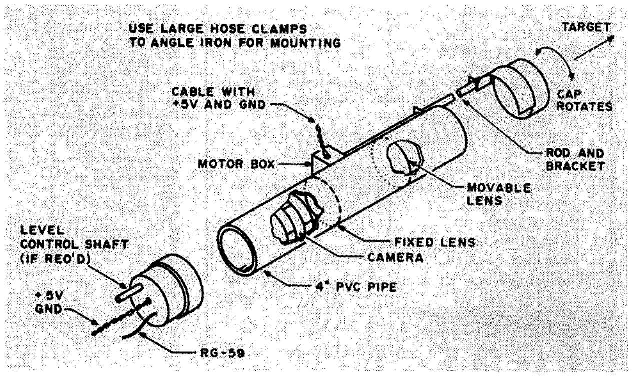

Fig. 16. Mechanical assembly of the camera.

Mike Zedan WD8JLW
4221 Lum Road
Attica MI 48412

Technical Clinic
PO Box 636
Sterling Heights MI 48078

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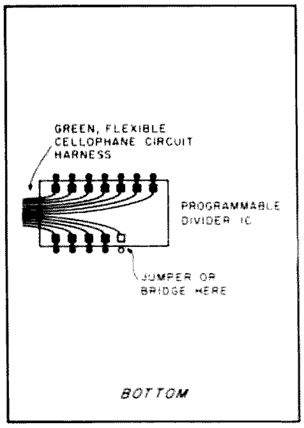

Fig. 1.

Being a group that takes pleasure in passing along useful information to fellow hams, Technical Clinic sends this public information bulletin on the 10-minute frequency modification for the new Icom IC-2A hand-held. The short and simple job will allow operation (depending on individual radio characteristics) from 141.000 MHz to 149.995 MHz.

TC was pleasantly surprised to discover that Icom has made another rig that lends itself to tinkering. This happened while one was on the bench for a product development experiment.

You will need only solder and a low-wattage soldering iron. The two-step operation is as follows:

1. De-solder the brown jumper wire from the MHz BCD thumbwheel switch. This will allow the MHz switch to run through its whole range.

2. Solder a small piece of wire (or form a solder bridge) at the position where the cellophane PC harness terminates at the programmable divider IC, as shown in Fig. 1. This allows the radio to recognize a request for 148 and 149 MHz.

That's it. You now have a radio with MARS/CAP capability which has not had any of its normal operation impaired one bit. It is hoped that all present and future owners of this rig will take full advantage of this mod once their individual warranties expire. ■

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SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

ARLINGTON HEIGHTS IL
FEB 7

The Wheaton Community Radio Amateurs will hold their annual hamfest on February 7, 1982, beginning at 8:00 am at the Arlington Park Race Track EXPO Center, Arlington Heights IL. Tickets are $3.00 at the entrance and $2.50 in advance. There will be free flea-market tables, expanded floor space, parking, awards, and a large commercial area, including the new computer section. Talk-in on 146.01/.61 and 146.94. For commercial info, call WB9TTE at (312)-766-1684; for general info, call WB9PWM at (312)-629-1427. For tickets, send an SASE to WCRA, PO Box QSL, Wheaton IL 60187.

TRAVERSE CITY MI
FEB 13

The Cherryland Amateur Radio Club will hold its ninth annual Swap 'N Shop on Saturday, February 13, 1982, from 8:00 am through 2:30 pm at the Immaculate Conception Middle School gymnasium, 218 Vine Street, Traverse City MI. General admission is $2.50 and single tables are $3.00. Talk-in on 146.85 and 146.52. For further information, contact Jerry Cermak K8YVU, Chairman, 3905 Slusher Road, Traverse City MI 49684. An SASE will be appreciated.

MARLBORO MA
FEB 14

The Algonquin Amateur Radio Club will hold an electronics flea market on February 14, 1982, at the Marlboro Junior High School cafeteria, Marlboro MA. Sellers will be able to set up from 9:00 am to 10:00 am and doors will be open from 10:00 am until 2:00 pm. Admission is $1.00. Tables are $5.00 if a written reservation is made before February 7, 1982, and $7.50 for any tables remaining after that date. Refreshments will be available. Talk-in on .01/.61 and .52. For reservations, contact Mac W1BK, 128 Forest Avenue, Hudson MA 01749.

MANSFIELD OH
FEB 14

The Mid-Winter Hamfest/Auction will be held on Sunday, February 14, 1982, at the Richland County Fairgrounds, Mansfield OH. Doors will open to the public at 8:00 am. Tickets are $2.00 in advance and $3.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Half tables are available. Features will include prizes, an auction, and a flea market, all in a large heated building. Talk-in on 146.34/.94. For additional information, advance tickets, and/or tables, send an SASE to Harry Frietchen K8HF, 120 Homewood Road, Mansfield OH 44906, or phone (419)-529-2801.

VERO BEACH FL
FEB 20

The Treasure Coast Hamfest will be held on February 20, 1982, at the Vero Beach Community Center, Vero Beach FL. Admission is $2.00 in advance and $2.50 at the door. Features will include prizes, drawings, a QCWA luncheon, and tailgating. Talk-in on 146.13/.73, 146.52/.52, 146.04/.64, and 222.34/223.94. For additional information, write PO Box 3088, Beach Station, Vero Beach FL 32960.

FAYETTEVILLE WV
FEB 21

The Plateau Amateur Radio Association will hold its fourth annual hamfest on Sunday, February 21, 1982, at the Memorial Building, Fayetteville WV. The doors will open at 9:00 am. Admission is $2.50 and children will be admitted free. Flea market tables are $2.00. All activities will be indoors and will include ARRL displays, forums, exhibits, door prizes, and women's programs. Hot food, refreshments, and free parking will be available. Talk-in on .19/.79 or .52. For more information, contact Bill Wilson WA8YTM, 302 Central Avenue, Apartment 2, Oak Hill WV 25901, or phone (304)-469-9910 or (304)-469-9313.

LANCASTER PA
FEB 21

The Lancaster Hamfest will be held on Sunday, February 21, 1982, at the Guernsey Pavilion, located at the intersection of Rtes. 30 and 896, east of Lancaster PA. Doors will open at 0800. General admission is $3.00; children and XYLs admitted without charge. Each 8-foot space with a table is $5.00 (limited to two tables for noncommercial use and six tables for commercial use). All inside spaces are by advance registration only, and the registration deadline is February 10, 1982. All vendors must set up between the hours of 0600 and 0800; reservations will not be held past 0900 hours without prior arrangement. There will be free tailgating in specified areas outside (if weather permits) on a first-come, first-served basis. Food will be served at the hamfest. Talk-in on 146.01/.61 or 146.52. For advance registration or more information, write SERCOM, Inc., PO Box 6082, Rohrerstown PA 17603.

ELKIN NC
FEB 21

The fifth annual Elkin Winter Hamfest will be held on Sunday, February 21, 1982, at the Elkin National Guard Armory, located one mile from Interstate 77 at exit 85, Elkin NC. Breakfast and lunch will be served at the hamfest by the Foothills ARC of Wilkesboro NC and the Briarpatch ARC of Galax VA. Talk-in on 144.77/145.37, 146.22/146.82, and 146.52. For table reservations, ticket inquiries, or other information, contact Earl Day WB4GQP, 131 Harris Avenue, Elkin NC 28621, or phone (919)-835-3509.

MORRIS PLAINS NJ
FEB 25

The Split Rock Amateur Radio Association will hold its annual equipment auction on Thursday, February 25, 1982, at the Morris Plains VFW Post #3401, located on Route 53 in Morris Plains NJ. Doors will open at 7:00 pm to unload and inspect equipment and the auction will get underway at 8:00 pm sharp. Admission is free. Please limit your items to working electronic equipment—no junk—and make sure any loose parts are bagged or boxed. The club will take a flat 10% commission on all sales of individual items up to $50. Above $50, the club will take a $5.00 commission on each individual sale. All commissions are payable in cash only. There will be refreshments available and the site has plenty of parking. In case of inclement weather, the auction will be held on Thursday, March 4, 1982, at the same location and times. The Morris Plains VFW Post is located approximately 1 mile north of the intersection of Routes 202 and 53 in Morris Plains NJ. For more information, write PO Box 3, Whippany NJ 07981.

GLASGOW KY
FEB 27

The annual Glasgow Swapfest will be held on Saturday, February 27, 1982, beginning at 8:00 am CST at the Glasgow Flea Market Building, 2 miles south of Glasgow on Highway 31E. Admission is $2.00 per person with no extra charge for exhibitors. One free table will be provided per exhibitor with extra tables available at $3.00 each. There will be a large heated building with plenty of free parking. No meetings or forums will be held—just door prizes, free coffee, and a large flea market. Talk-in on 146.34/.94 or 147.63/.03. For additional information, contact Bernie Schwitzgebel WA4JZO, 121 Adairland Ct., Glasgow KY 42141.

VIENNA VA
FEB 28

The Vienna Wireless Society will hold the 9th annual ARRL-approved WINTERFEST™ '82 on February 28, 1982, beginning at 8:00 am at the Community Center, 120 Cherry Street, Vienna VA. Tickets are $3.00 and include one chance for the prize drawing. Prizes will include a Kenwood TS-830S HF transceiver, an Icom IC-25A 25-W mobile 2-meter rig, and a Santec HT-1200 hand-held, as well as accessories and books. Excellent food service will be available. Featured will be dealers' and manufacturers' displays, an indoor flea market, and outdoor frostbite tailgating. Tables are

$5.00 and $10.00. Talk-in on .31/.91 and 146.52. For additional information, send an SASE to WINTERFEST™ '82, Vienna Wireless Society, PO Box 418, Vienna VA 22180, or phone Ray Johnson at (703)-938-8313.

DAVENPORT IA
FEB 28

The Davenport Radio Amateur Club will hold its 11th annual hamfest on Sunday, February 28, 1982, from 8:00 am to 4:00 pm in the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th Street, Davenport IA. Tickets are $2.00 in advance and $3.00 at the door. Tables are $5.00 each, with a $2.00 charge for an electrical hookup (limited number). Hotel discounts, food, and drinks will be available. Talk-in on 146.28/.88, W0BXR. For advance tickets and table reservations, write Dave Johannsen WB0FBP, 2131 Myrtle, Davenport IA 52804.

LAPORTE IN
FEB 28

The LaPorte Amateur Radio Club Winter Hamfest will be held on Sunday, February 28, 1982, at the Civic Auditorium, LaPorte IN, beginning at 8:00 am Chicago time. The donation is $2.50 at the door and reserved tables are $2.00 each. For reservations, write PO Box 30, LaPorte IN 46350.

AKRON OH
FEB 28

The Cuyahoga Falls Amateur Radio Club will hold its 28th annual electronic equipment auction and flea market on Sunday, February 28, 1982, from 8:30 am to 4:00 pm at North High School, Akron OH. Tickets are $2.00 in advance and $2.50 at the door. Sellers may bring their own tables or rent a table for $2.00. There is plenty of space and lots of free parking. Prizes include a Kenwood TS-130S, an Icom 3AT, and an Icom 2AT. A 16K TRS-80 Model III will be raffled at $2.00 per chance. Talk-in on 146.04/.64. For more details, contact CFARC, PO Box 6, Cuyahoga Falls OH 44222, or phone K8JSL at (216)-923-3830.

LIVONIA MI
FEB 28

The Livonia Amateur Radio Club will hold its 12th annual LARC Swap 'n Shop on Sunday, February 28, 1982, from 8:00 am to 4:00 pm at Churchill High School, Livonia MI. There will be plenty of tables, door prizes, refreshments, and free parking. Talk-in on 146.52. Reserved table space of 12-foot minimum is available. For further information, send an SASE (4 × 9) to Neil Coffin WA8GWL, c/o Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.

PHILADELPHIA PA
MAR 7

The Penn Wireless Association, Inc., will hold its Tradefest '82 on Sunday, March 7, 1982, at the National Guard Armory, Southampton Road and Roosevelt Boulevard (Rte 1), 2 miles south of exit 28 on the Pennsylvania Turnpike, Philadelphia PA. General admission is $3.00 and a 6'×8' seller's space is $5.00 (bring table) with an additional $3.00 for a power connection (limited number). There will be prizes, displays, refreshments, rest areas, and surprises. Talk-in on 146.115/.715 and .52. For additional information, contact Mark J. Pierson KB3NE, PO Box 734, Langhorne PA 19047.

WINCHESTER IN
MAR 14

The Randolph Amateur Radio Association will hold its 3rd annual hamfest on Sunday, March 14, 1982, from 8:00 am to 5:00 pm at the National Guard Armory, Winchester IN. Tickets are $2.00 in advance and $3.00 at the door. Table space is $2.50 and table space with table is $5.00. Setup times are 6:00 pm to 8:00 pm on Saturday and 6:00 am to 8:00 am on Sunday. For reservations or additional information, contact RARA, PO Box 203, Winchester IN, or phone W9VJX at (317)-584-9361.

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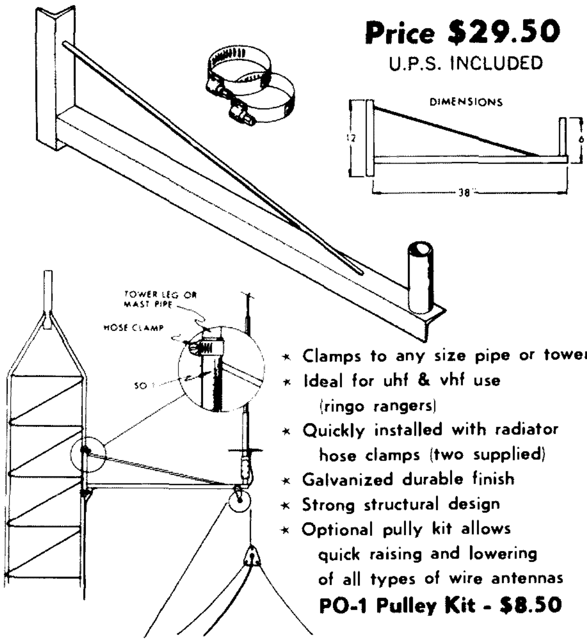

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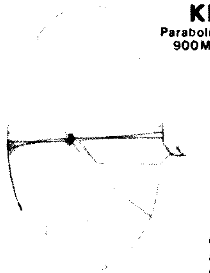

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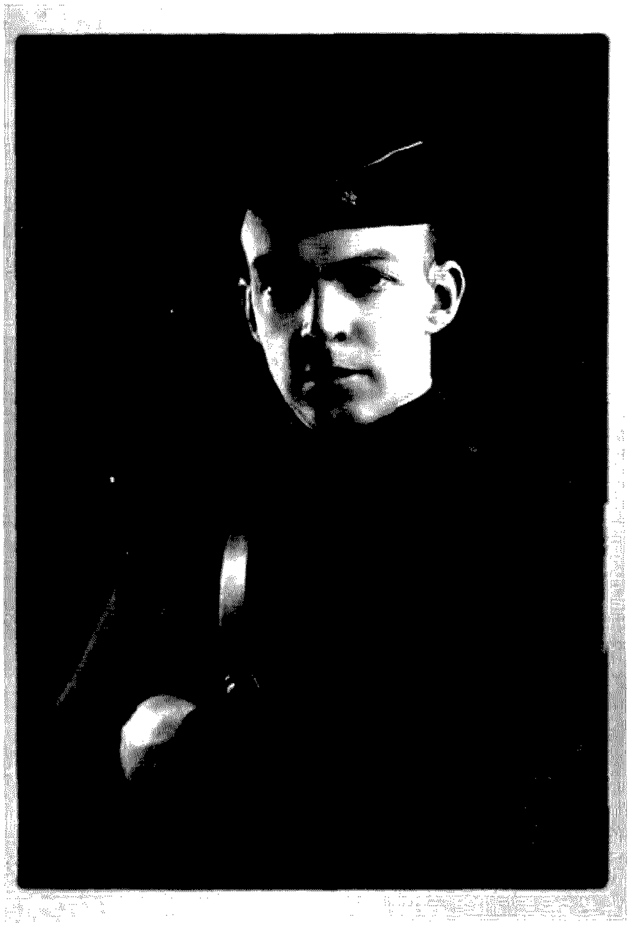
The Father of FM

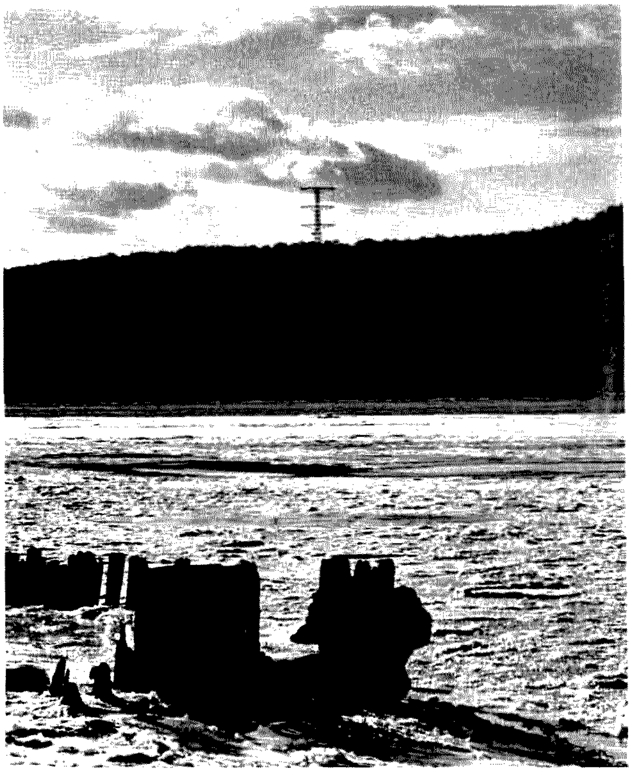
— the tragic story of Major E. H. Armstrong



Armstrong in WWI uniform. (Photo by Bradley B. Hammond)

Jeanne Hammond

Atop the Palisades at Alpine, New Jersey, across the Hudson River from Yonkers, stands a tall,



Armstrong's radio tower atop the Palisades at Alpine, New Jersey, as seen from Yonkers. (Photo by Jeanne Hammond)

three-armed tower. It is accepted as part of the landscape by those who live on the river's east bank and is seen daily by thousands of commuters on Conrail's Hudson Division trains, yet few know what this tower is or how it has affected their lives.

The tower and its accompanying radio station were built in 1938 at a cost of over $300,000 by Edwin Howard Armstrong, pioneer radio inventor, to demonstrate the superiority of his new system of radio broadcasting—frequency modulation (FM). After Promethean battles with the broadcasting industry, which fought to preserve its investment in the established system (amplitude modulation—AM), FM was finally accepted and today is the preferred system in radio, the required sound in TV, and the basis for mobile radio, microwave relay, and space communications.

As little known as the significance of the tower is the man who built it. Armstrong was born in New York City in 1890. When he was twelve years old, the family moved to 1032 Warburton Avenue—known to family and friends simply as "1032"—in Yonkers. The house, which still stands just up from the Greystone railroad station, was declared an historical landmark in 1978 by the Yonkers Historical Society.

Next door, on the north side of the house at the corner of Odell Avenue, was 1040 Warburton Avenue, the home of Armstrong's maternal grandparents. The members of the two families were a gregarious lot, and Howard's childhood was a happy one filled with large gatherings of relatives, many of whom were teachers. Learning was prized. "Quick, boy! How much is nine times five, minus three, divided by six, times two, plus nine?" His great uncle, Charles Hartman, principal of New York City Public School 160, would quiz his nephew to encourage his mental agility.

When Howard was fourteen years old, his father, who was American representative of the Oxford

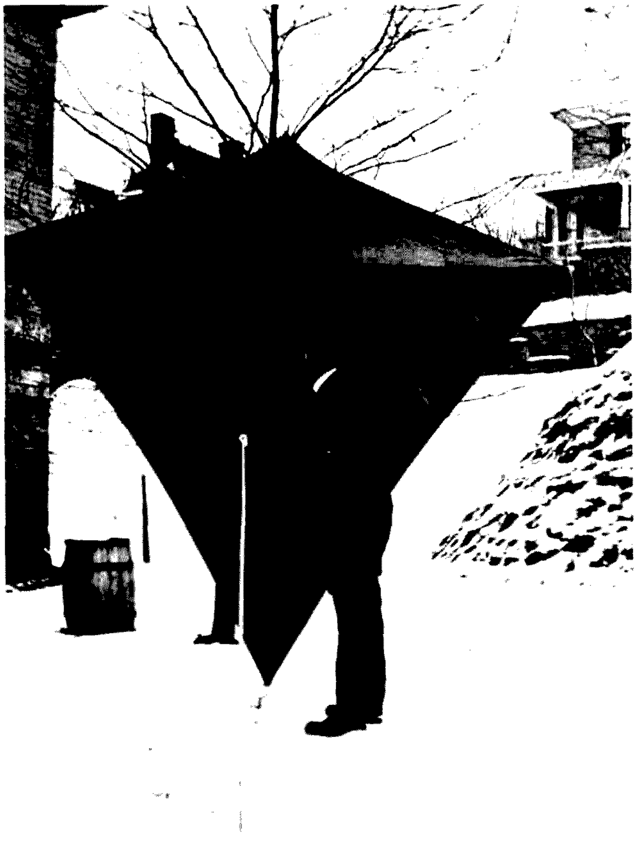
Howard Armstrong, about six years old, with his sister, Ethel.

1032 Warburton Avenue, Armstrong's boyhood home in Yonkers. His earliest experiments were carried out in the cupola on the third floor.

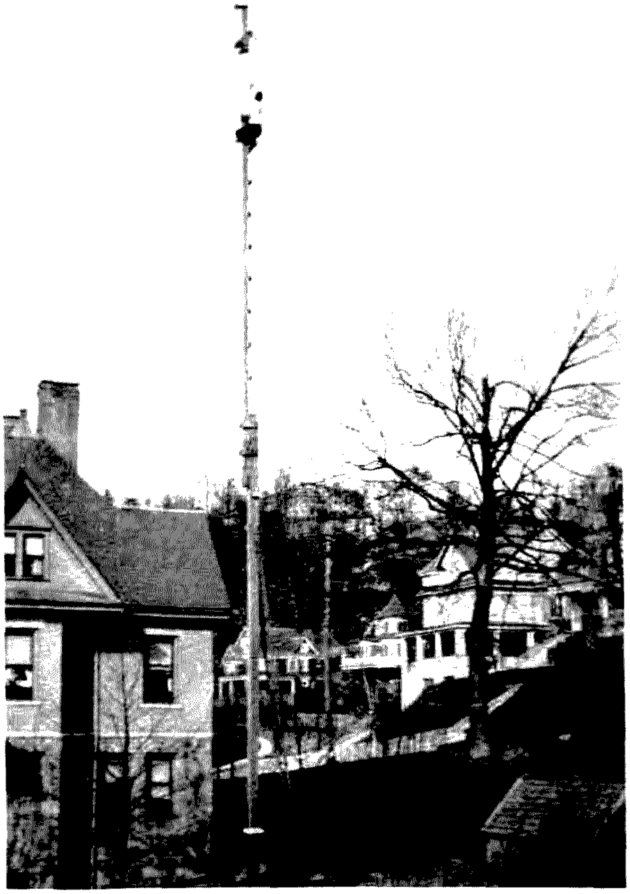
His bedroom/workroom in the cupola looked out on the spot on the Palisades where his radio station would later be. (Photo by Bradley B. Hammond)

University Press, bought him (on one of his yearly trips to London) a book, *The Boy's Book of Inventions.* Reading of Guglielmo Marconi's sending of the first wireless message across the Atlantic so excited his imagination that he determined then and there to become an inventor.

In his attic room in the cupola overlooking the Hudson River, Howard Armstrong began tinkering with radio. In those days, broadcast sound consisted of Morse code signals picked up with earphones. The incipient young inventor set out to make them louder. He was dogged in his search and developed at this early age a capacity for infinite patience in his experiments which was to mark his life's work. "Genius is one percent inspiration and ninety-nine percent perspiration," he



Armstrong constructed large antenna kites which he flew from the upper stories of "1032" in an attempt to improve reception.



The young inventor at work on the "1032" pole.

used to say in later years, quoting Thomas Edison.

Armstrong explored many paths in his attempts to strengthen the sound. Reaching up into the air to better catch the broadcast signals, he flew from the upper stories of 1032 large antenna kites which he had built with the help of his Yonkers friend, Bill Russell. He built a 125-foot antenna pole, the tallest in the area, in the south yard. His younger sister, Edith ("Cricket"), helped in the construction, holding the guy wires and handing him buckets of paint as he swung aloft in a boatswain's chair. Neighbors watched with awe and apprehension. His mother, however, had complete faith in her son. When a neighbor telephoned to say that Howard was at the top of the pole and it made her nervous to watch, "Don't look, then," was her confident reply.

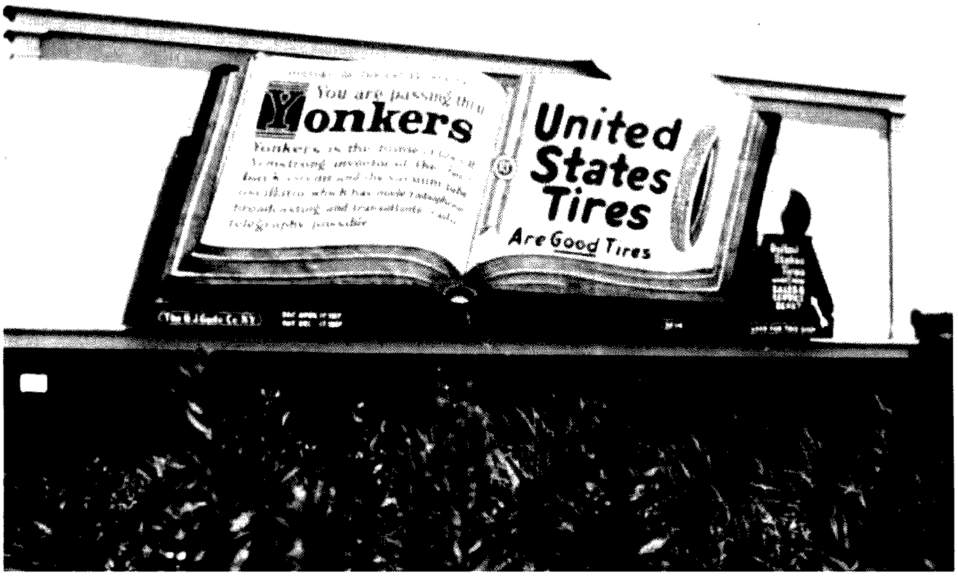
Howard attended Public School 6 in Yonkers and Yonkers High School, and went on from there to Columbia University, commuting on a red motorcycle his father had given him as a high school graduation present. His interest in radio led him to the study of electrical engineering.

In his junior year at Columbia, Armstrong's diligent search for improved radio reception paid off. He invented the regenerative-oscillating, or feedback, circuit which greatly increased radio signals, made them loud enough to be heard across a room and led the way to transatlantic radio telegraphy. His sister, Ethel, remembers vividly the night it happened. "Mother and Father were out playing cards with friends and I was fast asleep in bed. All of a sudden Howard burst into my room carrying a small box. He danced round and round the room shouting, 'I've done it! I've done it!' I really don't remember the sounds from the box. I was so groggy, just having been wakened. I just remember how excited he was."

Major Armstrong's sister, Ethel, and her husband, Bradley Hammond, listen to a crystal set with their evening meal, around 1920. (Photo by Bradley B. Hammond)

Later, another inventor, Lee DeForest, challenged Armstrong's priority for this discovery and the issue was twice argued before the US Supreme Court—which found in DeForest's favor. However, the scientific community has always credited Armstrong for the invention and he received a gold medal for it from the

Thomas J. Styles, Armstrong's longtime associate, Ethel, Howard, and his mother. (Photo by Bradley B. Hammond)



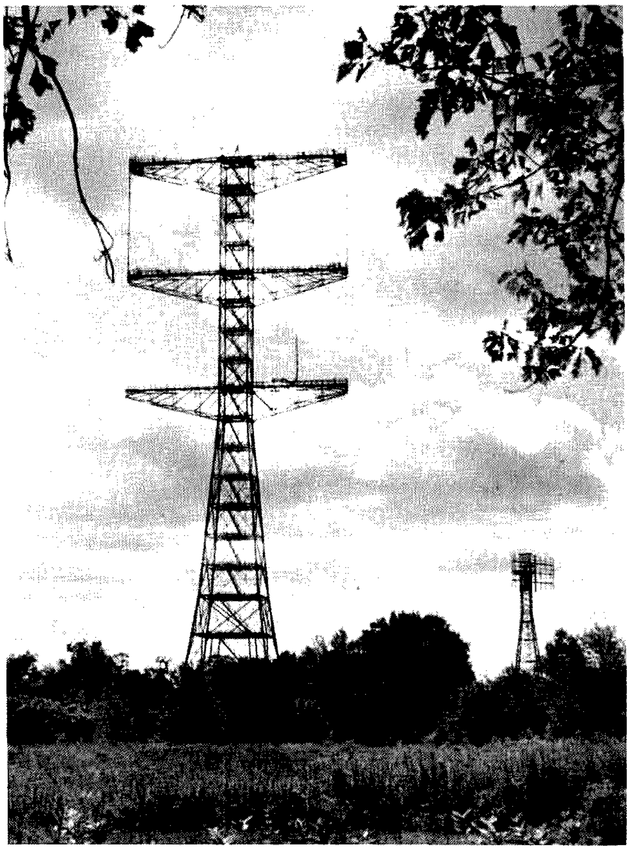
Billboard in Yonkers dating around 1921. (Photo by Bradley B. Hammond)

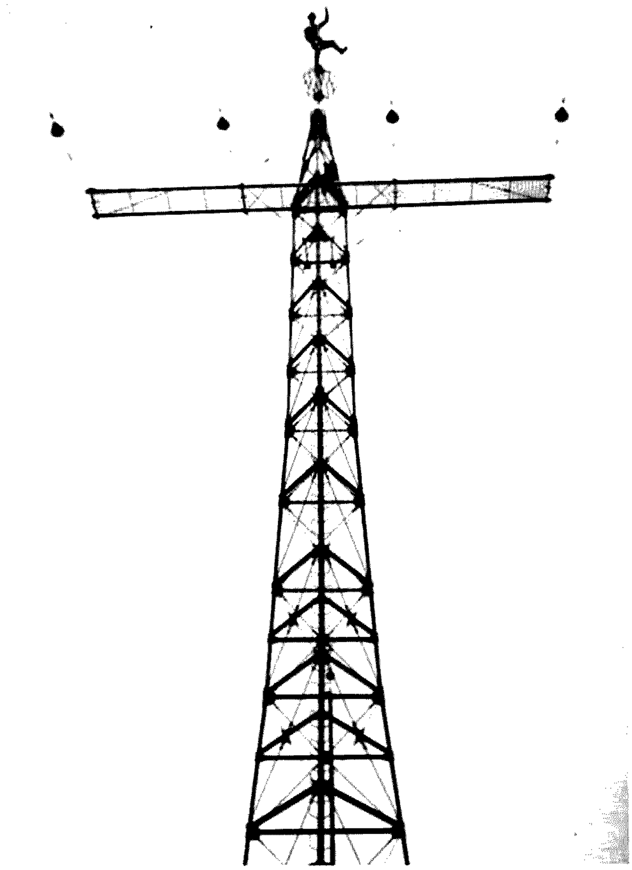
Institute of Radio Engineers. Years later, the report accompanying the presentation to him of the Franklin Medal, by the Franklin Institute in Philadelphia, also credited him with the invention of the regenerative circuit.

After graduation from Columbia in 1913, Armstrong worked as an instructor at the college. When the US entered the war in 1917, he joined the Army Signal Corps and rose to the rank of Major—his preferred title for the rest of his life. While in the service, he invented the superheterodyne circuit which amplified even further the sound of radio transmission. This invention brought him into contact with David Sarnoff, who later became President of Radio Corporation of America and whose bright and attractive secretary, Marion MacInnis, he later married.

After the war, Armstrong returned to Columbia where he worked as an assistant to Professor Michael I. Pupin, famed physicist and inventor. When Pupin


Armstrong and his wife, Marion, by the "1032" pole. (Photo by Bradley B. Hammond)


Close-up of the tower. (Photo by Bradley B. Hammond)



In 1923, to celebrate the opening of New York's first radio station—and to impress his fiancee—Armstrong cavorted atop the new WJZ transmitter tower. (Photo by George Burghard)

Armstrong receives the Medal of a Chevalier de la Legion d'Honneur *for his contributions to wartime wireless, from General Ferrie, head of French military communications.*

died, Armstrong took over his professorship and, financing his own research—his inventions had by now made him wealthy—concentrated on the elimination of static.

In 1933, Armstrong secured four patents which were to be the basis for frequency modulation. This was an entirely new system of broadcasting. Unlike amplitude modulation which varies the amplitude or power of radio waves to transmit sound, frequency modulation varies the number of waves per second over a wide band of frequencies. As static is transmitted by amplitude modulation and cannot break into the wide band of frequencies of frequency modulation, the latter is virtually static-free. Armstrong, who enjoyed aphorisms, liked to quote defeatists who said, "Static, like the poor, will always be with us." He proved them wrong.

The first public broadcast of FM was made in 1935 from the home of his friend C.R. (Randy) Runyon at 544 North Broadway in Yonkers. Runyon was a ham who operated under the call letters W2AG and broadcast from a tower in the yard of his house. The tower and the house are no longer standing. The Runyon living room served as a studio for a demonstration of different kinds of sound that were broadcast to a meeting of the Institute of Radio Engineers at the Engineer's Building on West 39th Street in New York City. Water was poured, paper was crumpled, and live and recorded music were beamed from the Runyon tower to the audience forty miles away.

Although the engineers marveled at the fidelity of the sound, FM did not immediately take off and it would be some time before it would become a commercial success. "If you build a better mousetrap the world doesn't necessarily beat a path to your door," Armstrong said ruefully in later years as he fought for the acceptance of his new system of broadcasting. As a matter of fact, FM was so revolutionary that an entire industry had to scrap its hardware and start over before its potential could be realized. Understandably, the establishment was less than enthusiastic at the prospect.

However, for several years RCA gave Armstrong experimental broadcast privileges in its studio at the top of the Empire State Building. But in 1937, saying that they wished to devote the space to the development of TV, they asked Armstrong to withdraw.

More determined than ever to prove the superiority of FM, Armstrong built his own station in Alpine, New Jersey. The site he chose had been visible to him as a boy from his attic cupola at 1032, and it served his purpose well. It was one of the highest

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points in the region and had unobstructed space around it for the broadcast of the station's signal.

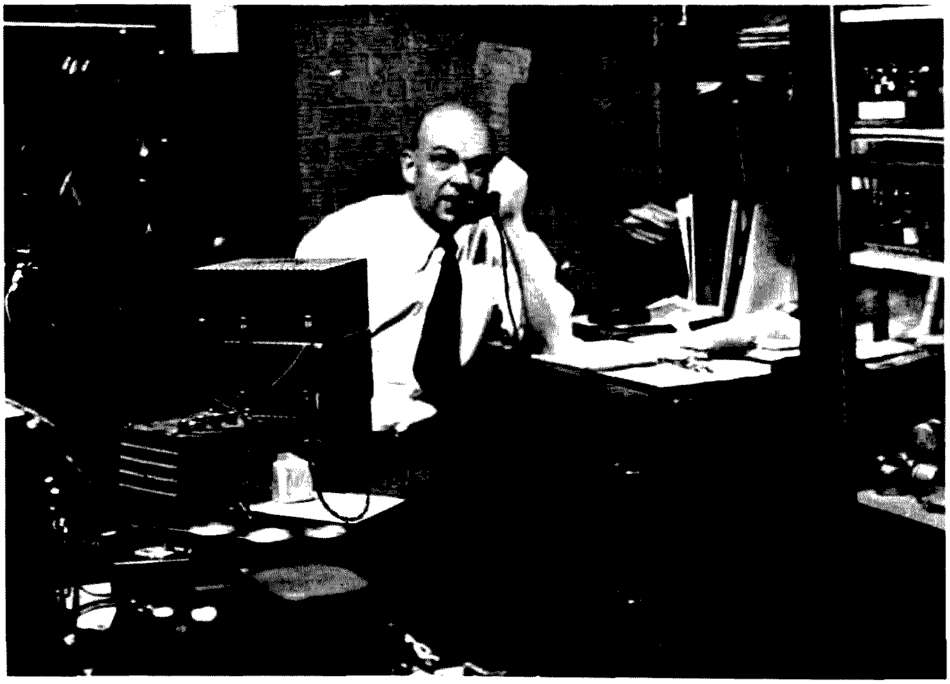
Programs originating with WQXR in New York City were transmitted by wire to Alpine and broadcast first under the call letters W2XMN and later, WE2XCC. Today, the station is owned by UA Columbia Cablevision Company of Oakland, New Jersey, and is operated for closed circuit TV transmission.

During the Second World War, Armstrong devoted himself to military research and allowed the government to use his patents royalty-free. He received the Medal of Merit for his contributions.

After the war, Armstrong turned his attention once more to the promotion of frequency modulation. He saw it grow in popularity as a broadcasting medium as more FM stations went on the air and more FM sets were sold to receive the programs. However, few outside the industry had ever heard of Edwin Howard Armstrong—the man who invented it. Furthermore, manufacturers began to build and sell FM equipment ignoring his patents. Goaded perhaps by the bitter memory of losing his regenerative patent years before, Armstrong became embroiled in twenty-one infringement actions to adjudicate his FM patents. Battling giant corporations with batteries of lawyers used up his resources. Finally, in 1954, ill, disillusioned, and his fortune gone, Armstrong took his own life.

After his death, his widow, Marion, set out to finish what he had started. She continued the lawsuits, sitting in the courtroom each day following the arguments and watching as testimony was given. Her first victory, over RCA in 1954, gave her funds to continue the other suits. In 1967, with the victory over Motorola, she had won all twenty-one and established clearly and decisively that Edwin Howard Armstrong was the inventor of frequency modulation.

Today, the Alpine tower stands as a monument to the brilliant man whose inventions touch our lives every day. His contributions are perhaps best summed up by Lawrence Lessing in his biography of Armstrong, *Man of High Fidelity* (J. B. Lippincott Company, Philadelphia and New York, 1956). "The lonely man listening to music in the night, the isolated farmer hearing nightly the news of the world, the airplane pilot guiding his craft safely through the ocean of the sky, the astronaut now in his capsule gathering in the whispers from space, the earthbound emergency crew contending with some mission of mercy or disaster, the army on the move and the man in his armchair, charmed or instructed for an hour by a great play, a symphony, a speech, a game of ball—all owe a debt to this man who, in some forty years of high fidelity, fashioned the instruments illimitably extending these powers of human communication."■



Armstrong at his desk at W2XMN.

Karl T. Thurber, Jr. W8FX
317 Poplar Drive
Millbrook AL 36054

The Art of Listening

—audio accessories explored

In this interesting and highly-readable article, W8FX highlights in a casual, nontechnical way some important considerations in choosing key audio accessories for your station. Whether a licensed amateur or a serious shortwave listener, we think you will be interested in what he has to say about speakers, headphones, tape recorders, and filters for the ham shack.

A high-quality station receiver having attributes of acceptable selectivity, sensitivity, stability, image and spurious signal rejection, and accurate readout forms the heart of any installation—amateur or SWL. Due to cost considerations, front-panel control space limitations, and other factors, not all desirable features can be included. In this article, we look at important audio-related accessories that can be used in tandem with a good set for outstanding performance and versatility. These include proper headphones and speakers, audio filters, and tape recorders. The front-panel phone jack provides the umbilical connection for these devices. The Kenwood R-1000 receiver pictured here has one interesting feature of special interest to SWLs: The function switch at upper left controls a timer used to turn on the radio for scheduled listening or to control a recorder through a remote terminal. (Photo courtesy of Trio-Kenwood Communications, Inc.)

No transceiver or receiver is perfect, and none comes complete with all possible accessories to fill every operating need. The design of such a radio would certainly push the technical state of the art, not to mention that it would most certainly be cost-prohibitive. Various accessories and modifications narrow the gap between needs and reality and allow one to tailor performance accordingly.

There are many receiver audio add-ons one can build or purchase: external speakers, headphones, tape recorders, audio interference filters, phone patches, radioteletype (RTTY) and Morse code readers, slow-scan television (SSTV) viewers, and monitorscopes, to name but a few performance-enhancing accessories.

In this article, we will look at construction and selection considerations for the first four groups listed above. Our review will highlight a number of commercial phone-jack products from the standpoint of their contributions to material reception improvement and making on-the-air operating a more convenient and enjoyable pastime.

Let's begin with the main link between your rig and your ears—the speaker.

Speakers: A Special Breed

Anyone who rates himself or herself a hi-fi buff knows just how important the speaker is to overall audio system performance. Unfortunately, the speaker's importance to receiver or transceiver performance is too often forgotten—by the individual ham and by manufacturers as well. Most amateur equipment made today, whether of domestic or Japanese origin, contains but an undersized, inexpensive, and inadequate loudspeaker. This results in poor audio performance from otherwise excellent equipment. Deficiencies are magnified when equipment is stacked, since the speaker is normally mounted on the top or bottom of the radio where its output will be muffled by the operating desk or other equipment above or below the radio.

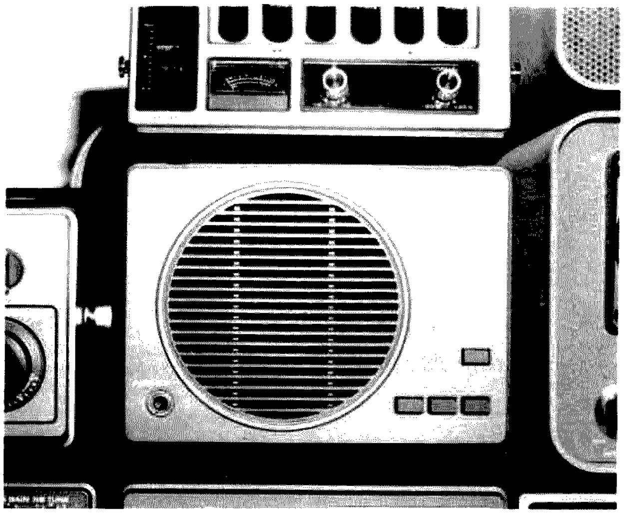
Most radios have provisions for using an external speaker, and I recommend you use one to help attain the overall performance you expect from your set.

Fixed station external speakers. It's a good idea to obtain the matching accessory speaker at the time of the receiver or transceiver's purchase. However, you should be able to use almost any communications speaker as long as the voice coil impedance matches that of your set's output, normally 8 Ohms (4-16 Ohms is the usual range).

Only a *communications*-type speaker should be used, however, as the restricted frequency response of these units is optimized for speech reproduction. Hi-fi speakers, though perhaps of superior overall quality, will unduly accentuate any low-frequency hum as well as high-frequency noise and background hiss.

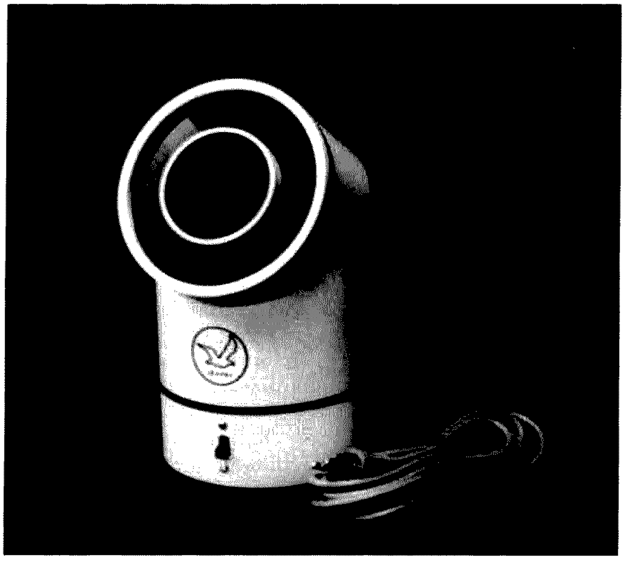
Of late, I've observed that accessory speakers offered by some manufacturers are marginal in size and quality; hooking up one of these units will not produce the improvement one would expect from an external speaker. A possible remedy is to scour the next hamfest or swap meet for one of the 8- to 12-inch boat-anchor speakers of the 1950s and 1960s bearing such names as National, Hallicrafters, Collins, and Hammarlund. These units, if in good condition (voice coil intact and speaker cone undamaged), will run rings around the 4- to 5-inch jobs seen today. A little clean-up, and possibly a paint job, will do wonders to restore a unit to respectability.

You can "roll your own" versions of these increasingly difficult-to-find accessory speakers, too; your effort will likely be rewarded with superior speech quality and intelligibility. Send for the catalog of McGee Radio and Electronics, 1901 McGee St., Kansas City MO 64108. It's chock full of speaker and enclosure possibilities at moderate prices. Select a 6-inch-diameter or greater unit that will handle 5 to 10 Watts of audio power.

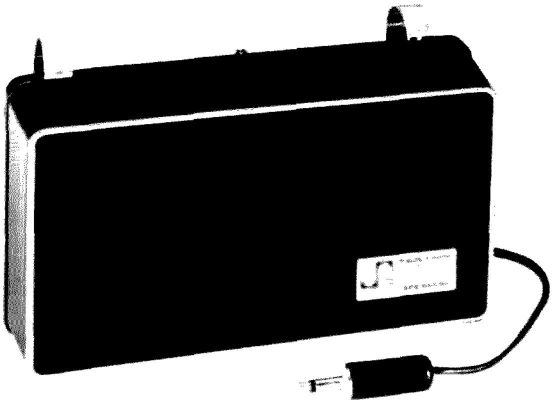


An external speaker is a near-must in view of the minimal speaker usually provided in most amateur gear produced today. The Kenwood SP-180 shown here is designed for use with the TS-180 series of gear; it has a few "bells and whistles" of its own. These include three selectable tone filters and two-channel selectable input. The headphone output can be routed through the tone filters, too.

For the experimentally inclined brasspounder, Skytec offers an unusual designed-for-application CW speaker. This acoustically tuned unit develops virtually single-signal selectivity for excellent Morse reception. The CW-1 combines an acoustic filter resonant at about 750 Hz with a loudspeaker in a small enclosure; a sleeve in the output opening may be extended



Skytec CW-1 speaker is an unusual device that is expressly designed for receiving CW radiotelegraphy. The unit combines an acoustic filter resonant at about 750 Hz with a loudspeaker to closely approximate "single-signal" selectivity. (Photo courtesy of Jim Bowles W6DLQ, Skytec)



Mobile installations can benefit most of all from a carefully-chosen and properly-installed external speaker. Built-in speakers found in most HF and VHF/UHF mobile sets are inadequately sized and positioned to compete with road noise, car sounds, and passenger chatter. Inexpensive CB-type units usually work well, or a specially-designed unit such as this Heathkit® portable twin speaker can be used. Unit includes a visor mount to help direct sound downward to overcome road noise. (Photo courtesy of the Heath Company)

to vary the resonant frequency slightly.

How does it work? In the Skytec speaker, back radiation from a vertically-mounted loudspeaker near the base is deadened by sound-absorbent material. A cylindrical sound chamber (tube) is coupled to the front of the speaker through only a small hole in a plate that otherwise closes the lower end of the tube; the tube's upper end is open to the room. At the frequency at which the chamber length is acoustically one quarter wave long, it is resonant and acts as a matching section between the high impedance (to sound) of the small hole at the speaker end and the low impedance to the room of the open end. Audio energy transfer is very efficient at this frequency but it falls off sharply off-resonance.

Using this special-purpose speaker, desired signals can be peaked considerably (on the order of about 20 dB), while adjacent channel signals still can be heard in the background. This feature allows the band to be conveniently scanned without the need to switch back to the regular station speaker. The speaker can be used in conjunction with standard intermediate frequency (i-f) filters and narrow-bandpass audio-frequency (af) filters, as well. However, the filters must be compatible; that is, bandpasses must be centered on the same frequency. Thus, other filters may or may not be used to advantage with the CW-1, depending on whether their peaks may be set such that the audio pitch that results is within the speaker's response capability.

You also may want to route your radio's output to a remote location such as the workshop, patio, bedroom, or yard. A general-purpose PA type speaker (weatherproof for outdoor use) will usually fill the bill. It's advisable to allow switching between the in-shack speaker and the extension, and also for separately controlling the volume on the remote speaker. An FM wireless mike module also may be used to broadcast received signals to any standard FM receiver in the home or around the yard—more on this possibility later.

You may have noticed that many of the bells and whistles now standard on the latest transceivers and receivers are finding their way into accessories of all kinds. For example, the external speaker for my Kenwood TS-180S is not just a speaker, but a triple audio filter, audio distribution point, and headphone jack box; it can handle the outputs of two receivers, or a receiver and a transceiver. The two af filters are fixed-tuned and push-button-selectable to attenuate either low-frequency (below 400 Hz) or high-frequency (1.5 kHz or 3 kHz up) signals. The headphone output is switchable through the filters, as is the output from either audio source. A line-out jack on the rear apron provides a convenient source of filtered audio for RTTY, SSTV, monitorscope, and other applications where receiver audio is required.

The speaker's fixed filters can't compete with sophisticated "active" audio filters, but can do a good job augmenting existing i-f filtering. The narrowing of the af bandwidth to attenuate the noise component after i-f processing can materially enhance reception.

Speakers for the mobile rig. Practically all mobile amateur transceivers contain small internal speakers. The harsh sound and restricted size and range of most puts a crimp in the quality of reception of *all* signals. Although many radios have the speaker installed on the top of the rig so that the driver will hear it best, most sets aim the speaker downward—the worst possible direction. The set's full audio output is directed where it is largely absorbed by floor mats and carpeting. Even with solid-state equipment, cranking up the audio gain to overcome road noise and passenger conversation can result in microphonic-type squeals from the transceiver due to acoustic coupling back through the rig's innards.

Thus, even more so than in fixed-station operation, an external speaker is clearly desirable. Extension speakers markedly improve intelligibility when positioned and aimed better than the rig's internal speaker and will probably be more efficient than the set's speaker. This fact allows the transceiver's usual 2- to 3-Watt audio stage to be throttled back, resulting in less overall distortion—a real problem with some of the less-weighty mobile rigs, particularly handie-talkies.

A hi-fi speaker, such as that used for automobile FM/AM/tape-deck use, should not be used for the same reasons discussed previously. Instead, a 3- to 5-Watt communications-type speaker should be purchased, one designed expressly for the speech range, 300 to 3000 Hz or so. An inexpensive source of this kind of speaker is the CB market, still flooded with a mass of unsold accessories as well as two-way radios. The quality of CB-type units varies all over the spectrum, but with speakers sometimes going for $4 to $5 at discount and parts-store sales as well as hamfests and CB coffee breaks, it's not too much of a risk to try one out. Other sources of quick-and-easy mobile speakers are the small speaker boxes which are a part of many telephone amplifiers, such as the Radio

Shack 43-230 and similar units. Though small, these units seem to be adequate for casual FM-style mobile work. Old police or taxicab speakers in good condition also can be used.

For the operator who likes to occasionally use his handie-talkie in the family buggy, Heath's HDP-1228 clip-on sun visor speaker is a good bet. The 7-oz. dual speaker has two large mounting fingers (similar to those used on visor mirrors) to hold the speaker onto the visor just above the driver's head. This method of mounting allows optimum positioning of the speaker to direct the sound downward where it's needed to overcome road noise. An eight-foot-long cord and mini-plug allow easy connection to the HT or any other mobile transceiver. (This item, manufactured by Superex Electronics Corp., may have been discontinued by Heath, as I haven't seen it advertised in recent catalogs.)

Just about any CB-type external speaker will yield adequate results. However, there is one new amateur unit on the market that warrants mention: the Kenwood SP-40. This is a compact, but high-quality, lightweight (.44-lb.) speaker having a power handling capability of 3 Watts with a frequency response of 400 to 5000 Hz. Although speaker size is only 57 mm, the little unit appears to be quite efficient and free of annoying resonances and vibrations that too frequently plague lesser CB counterparts. The speaker leg has a magnet so that it easily can be mounted on any magnetic substance. If the speaker is to be installed in a location where the magnet can't be used, mounting screws or double-faced adhesive tape also can be used. Somewhat on the expensive side (about $25), the unit nevertheless represents good value (I own two, one for each automobile). The speaker's aircraft-instrument styling makes it an especially attractive complement to any mobile installation.

Headphones for the Ham Shack

Loudspeakers are great for armchair-copy SSB work and for casual, FM-style operating. But there are a number of advantages in owning and using a good set of headphones as an adjunct to the trusty station speaker.

Many DX signals are too weak and QRM-obscured to be properly copied on a loudspeaker; a good set of phones will be of considerable value in increasing your ability to pull weak and near-buried signals out of the pack, particularly on CW. Room, household, and outside distractions also will be markedly reduced, allowing maximum concentration on the signal being copied. The overall effect of using headphones can be about equivalent to doubling received signal strength, when compared with straight loudspeaker listening. This may mean the difference between a solid DX contact and none at all.

A secondary, yet important, reason for using headphones is that the phones isolate the ham shack from the rest of the household, whose members may not appreciate the objectionable whistles, squawks, and other noises that are music to the ham's ears. This is especially important when practicing code, since Morse blasting forth at 750 Hz can have a very shrill and unnerving quality that readily penetrates walls, ceilings, and floors—not to mention *people!* Apartment and condo dwellers are well aware of how unpopular Morse can be with the neighbors.

I built a small FM rebroadcaster for cord-free headphone monitoring in my ham shack. The unit shown uses the 100-mW Ramsey FM module, which easily can be tuned to a clear spot on the FM band. Output of the station's TS-180S, FRG-7, or R-1000 is fed through the Autek Research QF-1 audio filter to the FM unit. A pair of lightweight "radio headphones" completes the installation.

Communications phone requirements. Many beginners start out by appropriating the closest set of stereo hi-fi phones for their rigs, with little thought of whether the unit can do the job. Most decent stereo phones can be used, but because they are designed for high-fidelity reproduction, their wide frequency response may elevate internal receiver hum and noise to an objectionable level; also, some lead-switching needs to be done to adapt them for monaural use.

Far better, and a more suitable investment for a lifetime amateur radio career, is a good pair of *communications*-type headphones. Such phones will boast a relatively narrow frequency response, high sensitivity, and easy physical adjustment. They also will be designed for comfortable wearing over extended periods, and the earmuffs will be effective in isolating the operator from distractions. Several manufacturers sell communications-type phones, including Telex, Superex, Radio Shack, and Amplivox. Major ham gear manufacturers such as Kenwood and Yaesu offer a selection of radio headphones designed to both physically and electronically match their equipment lines.

Several considerations emerge. Input impedance should match the output impedance of the receiver or transceiver's audio stage. In almost all solid-state amateur gear this is low impedance, in the 4-to-16-Ohm range; normally, 8-Ohm headphones should be obtained, though lower-impedance units will probably work nearly as well. Some older ham gear was designed for high-impedance phones, usually 1k to 5k Ohms, however; imped-

A good pair of headphones will last a lifetime of hamming. Though communications-type phones are usually recommended, high-quality stereo headphones are often preferred because they usually sport extra-soft, oversize cushions and padded, adjustable headbands. An adapter cord or plug would be required to convert a stereo phone such as this Radio Shack unit for monophonic use with your *receiver or transceiver. (Photo courtesy of Radio Shack)*

ance matching is more critical in such instances. Most military surplus headphones, often attractive because of their rugged construction and oversize earmuffs, are 500-to-600-Ohm units, though they are sometimes seen in higher- and lower-impedance versions.

Sitting in front of a ham rig for many hours at a stretch is fatiguing. Doing this while wearing an uncomfortable set of headphones, sporting a tight and close-fitting headband, is torturous. For reasons of retaining one's sanity and a pleasant disposition, it's critically important to purchase earphones having good earmuffs; the muffs keep the signal in and distractions out. Thick, but soft, flexible pads are what are required; they should be held fairly tightly against the head by the headband's pressure, though not so tightly as to be noticeably uncomfortable. One should be careful in purchasing used headphones, even if they're OK electrically, because old earmuffs eventually become shopworn and stiff, primarily due to their having been soaked in the operator's perspiration. Deterioration of the high-frequency response is the result, along with a reduced isolation ability. Overly large, heavy headphones should be avoided due to the discomfort caused by carrying their weight over an extended period.

Some features to look for include a coiled cord, individual headset volume controls, interchangeable or easily-replaceable earmuffs, type of headband construction (single, double, padded, etc.), and a means of adjusting the headband. These factors may be either pluses or minuses, depending on individual operator preferences.

I have found that buying headphones is one task that is best done in person, not by mail. It's important to try out the phones, if possible with the radio with which they will be used, both from the standpoint of equipment compatibility and operator comfort. All the printed specs in the world are useless if you can't comfortably wear the phones over a long timespan. If possible, borrow several different phones from friends and check out their suitability in your own station before making your choice.

Except for mobile work, where a *single* headphone may be worn in conjunction with a boom mike/headset combo, a *pair* of headphones is universally used. Since the human hearing system tends to cancel out noise which is applied equally to both ears, adding the second headset allows recognition of signals several dB lower in level than with a single headset. Also, most people do not have equal or symmetrically balanced hearing in both ears; dual phones tend to minimize this anomaly.

A few headphone operating tips should prove helpful:

1) Try using a pair of fitted earplugs under the headphones. Desired signals will come through the earplugs fairly well, while noise will be suppressed. Using earplugs is particularly effective when working on an extremely noisy band for a long stretch. You also may find fatigue is reduced.

2) Experiment with reversing the audio leads to one headphone. The human ear tries to cancel out noise which is presented in-phase to both ears; swapping the normally in-phase headsets can produce a substantial readability improvement while letting the signal of interest through with minimum impediment. If results are favorable, you may wish to install a switch to conveniently reverse phase for routine listening.

3) Learn to "ride gain" on your set's rf and af gain controls, avoiding "blasting," which will have the temporary but undesirable effect of desensitizing the ears. Generally, best CW copy is had by running with the af gain wide open (or nearly so) and working with the rf gain control, keeping levels low enough to avoid receiver and headset overloading. A good receiver agc system makes doing this a lot easier.

4) When operating on CW, carefully adjust the set's main tuning or beat frequency oscillator (bfo, if the set has one) to produce a strong yet pleasant audio tone. Don't opt for a too-low pitch; around 750 Hz is usually about right, give or take 100 Hz, or so.

5) If you're an inveterate SSB contester, consider the use of a boom mike/headset combo. This device replaces, or supplements, the transceiver's existing mike and speaker. The boom is attached to the back of one of the headphones and curves around the operator's cheek, thereby positioning the mike directly in front of the mouth for close-talking and essentially hands-free operating. A press-to-talk (PTT) switch is part of the cord itself, though most boom-mike assemblies can be "hot-wired" and a foot-switch used for PTT switching for true hands-off operation. Use a double-headset type for fixed-station operation and ensure that mike and headphone impedances are right for the transceiver or receiver/transmitter pair with which the combo is to be used. Avoid cheap CB-type boom assemblies like the plague!

6) If you want to try cord-free headphone operation, purchase a pair of lightweight, cordless FM radio headphones—the kind that has a built-in FM or AM/FM radio inside the headphone

itself—and feed your rig's output to a small wireless FM broadcaster module. Doing this allows true cord-free flexibility in the ham shack by doing away with clumsy, entangling headphone cords. The setup also has the benefit of allowing one to monitor band or net activity anyplace in the home or yard by tuning in the rebroadcaster on any standard FM receiver. Ramsey Electronics, 2575 Baird Rd., Penfield NY 14526, sells a simple, 300-foot-range kit for $3.95. Food for thought!

Using stereo phones. We have cautioned against using stereo hi-fi headphones in the ham shack, regardless of their quality and comfortability. Headphones with extremely wide frequency response characteristics simply reproduce additional interference, detracting from desired signals. Nevertheless, many hams will wish to use a pair of existing stereo phones for reasons of economy or personal preference. Hands-on experimentation will reveal if the pair will, in fact, be suitable for use.

Unfortunately, you can't just plug a set of stereo phones into your ham rig. Almost all such headphones use a so-called standard three-conductor (including ground) plug, one circuit being used for each channel. Most amateur equipment uses a two-circuit (including ground) jack for use with *monaural* communications headphones. This fact requires replacement of the headphone's 3-circuit plug with a single-circuit plug and the paralleling of the two separate leads so that the receiver's output will be fed to both headset units. Alternately, the stereo headphone's plug can be left intact and an adapter purchased or fabricated to convert the stereo-configured cord to monaural use. Using an adapter has the advantage of allowing the headset to be used as a stereo unit whenever desired, without making further wiring changes.

If you *do* purchase a set of stereo headphones to use with your ham rig, consider a suitable pair that has an internal "stereo-mono" switch. This feature alleviates the need for an adapter plug. I own a Calrad 15-135 headset that does a creditable job both in the ham shack and with a small stereo set, and it boasts individual earphone volume controls, a coiled cord, and comfortable muffs.

I've indicated that the stereo headphones' wide frequency response may be annoying when used with ham gear. This may be particularly aggravating if you try to use a pair of stereo phones in tandem with an active audio filter, since the filter may emphasize residual ac hum and noise present in the receiver or transceiver's audio output. You can minimize this problem by adding a 50- to 150-Ohm, 1/2-Watt resistor in series with the headphone lead to cut down their low-frequency response and overall sensitivity. The exact value to use must be determined by experiment.

Using a high-quality pair of communications-type headphones has several advantages. Switching from speaker to headphones can materially improve the readability of received signals and keep distracting room noise out. Lightweight units with soft cushions that are peaked for communications-range audio are best. Low-impedance models, such as the Yaesu headset shown here, are suitable for most modern solid-state receivers and transceivers. (Photo courtesy of Yaesu Electronics Corporation)

Tape Recorders

Though by no means necessary accessories, tape recorders represent often overlooked but very useful station adjuncts. There are countless practical uses for recorders, many of which are suitable for the ham shack. In fact, many amateurs wouldn't be without one any more than they would be sans mike or key.

Ham shack applications. Small recorders have a wide range of applications in the ham shack that is limited primarily by the individual operator's ingenuity and imagination. Recorders can be used for such diverse purposes as recording DX and other important contacts, verifying transmitted audio quality, recording messages and traffic, code practice, making short CQ and other transmission tapes, signal reporting, and SSTV signal origination, to name but a few popular uses. Let's look at some of these:

1) *Taping contacts.* This represents the most common, obvious use of the recorder. The machine is simply connected to the receiver's output jack, either through a Y-plug across the speaker or, in some sets, to an auxiliary tape-output jack. The tapes made can serve as documentation for exceptionally rare QSOs and as a logging aid in fast-paced DXing and contest work. (In the latter application, a reference time is recorded at the beginning of the tape so that log entry times can be conveniently determined.)

2) *Signal reporting.* Another common use is to provide "live" signal reporting to others. Most hams are genuinely surprised to learn how they really sound over the air, particularly at a far-distant location. They are usually highly appreciative of an offer to play back their signal to them as much more meaningful than a simple readability-and-strength report. If you make a practice of providing on-the-air playback, keep the engineering practice up to snuff: hardwire the connections (no mikes placed up against the set's speaker), and ensure that your wiring arrangements permit professional switching between mike and recorder. Random bleeps and fast-forward monkeychatter are not well received over the air. A recorder with an accurate tape counter is a near-must.

3) *Transmitted signal quality checking.* A good

The uses for a tape recorder in the ham shack are legion: taping QSOs, CQs, code practice, traffic for relay, etc. The recorder is probably of most use to the SSTV enthusiast in editing programs and recording QSOs—though recorders for SSTV work must be a cut above the average home-type cassette. The Sony C-104, shown above, is ideal for these purposes.

way to find out how *your own* signals sound is by using your recorder to tape them. You will need an auxiliary receiver for the purpose, one whose antenna can be disconnected or which has an attenuator to eliminate front-end overload by your own signal. You can record your actual on-the-air transmissions and QSOs, of course, but if you do any extensive "hello . . . testing" for the specific purpose of making a tape check, be sure to use a *dummy load* rather than radiating a signal.

4) *Code practice.* You easily can make custom code-practice tapes using your key, keyer, audio oscillator, and/or keying monitor in your transceiver or transmitter to feed the recorder's input. If you have an open-reel machine, you can in most cases vary the recorder's speed in a 2:1 ratio, that is from 1-7/8 to 3-3/4 ips, or from 3-3/4 to 7 ips. This capability allows code tapes recorded for the level of instruction desired (audio pitch will change, naturally). The recorder also can be used to tape on-the-air code practice sessions regularly broadcast by W1AW, the ARRL station at Newington, Connecticut, for later playback and practice.

5) *Traffic handling.* Using a recorder as a running backup in traffic handling is a good idea practiced by many experienced brasspounders. If you handle a great deal of traffic, you know that a telephone call or other unwanted interruption can make you miss part of a message or cause you to hold up your net while you get a "fill." Using the recorder, you can effectively tape your own fills.

6) *Taping CQs and other transmissions.* There is nothing wrong with prerecording phone CQs, if the practice isn't overdone and technical quality is maintained. For the most part, tape-recorded CQs are not necessary, and those using them often sound a bit silly. However, for contesting and some DX work, there *are* time-saving possibilities. A related application lies in making extended antenna adjustments and TVI checking. Since radiating an unmodulated carrier is illegal (except for short periods), you may want to prerecord a signal which can be played through your transmitter again and again. For both these applications, special continuous-loop tapes are available; these come in various lengths to fit the desired transmission message length. Again, the watchword is moderation—don't overdo a good thing!

7) *SSTV recording and playback.* The tape recorder is a "must" for the SSTVer, who finds a wide range of specialized applications. These include generation of gray scale, test pattern, and other reference signals; immediate playback of the other fellow's over-the-air picture; and building a library of interesting programs from two-way contacts. By far the most important use is in prerecording one's own "programs" for later broadcast. This allows for careful preparation and capturing of artwork and photography, tape editing, and review. The judicious use of a simple tape machine has enabled many SSTVers to produce very smooth, interesting and professional-quality program material that's a pleasure to watch.

8) *Computer interface.* Small cassette recorders provide the basic means of programming home-type microcomputers. If you're equipped with a microcomputer with an electronic RTTY and/or CW interface, the recorder provides the means to set up the computer for RTTY or Morse transmission and reception, and it also serves other ancillary functions. For example, in the author's Macrotronics M-650/PET 2001 system, the recorder is used to prerecord messages for later transmission and to record received messages. So-called "brag tapes" and artwork can be stored on the tapes and exchanged with others.

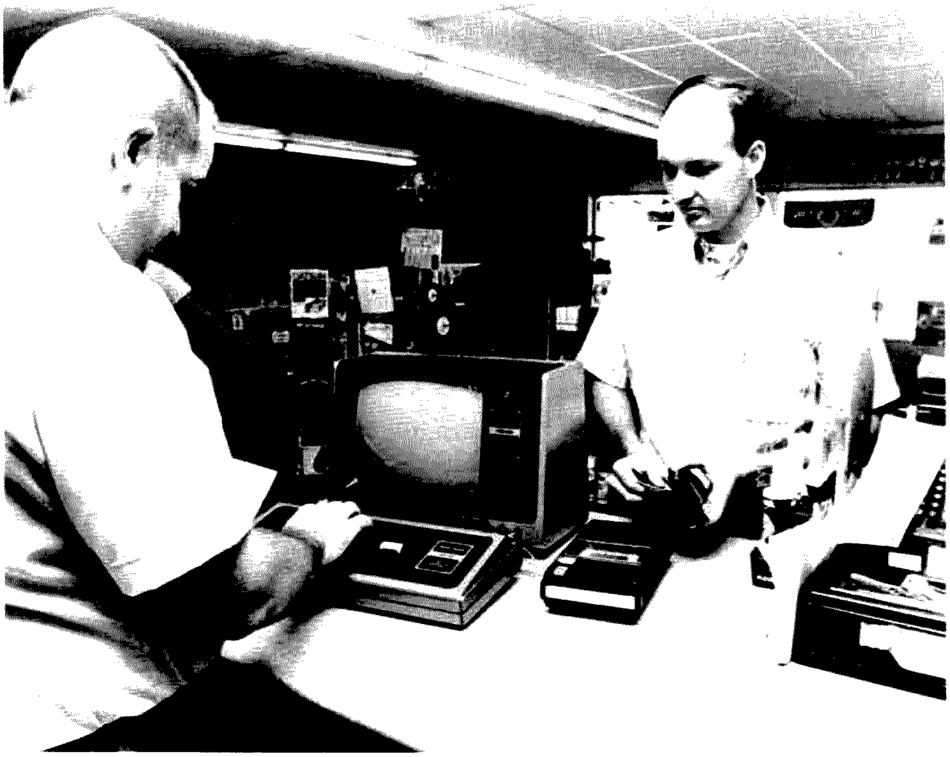
Besides these specific uses, it's often handy to use a tape recorder to verbally document equipment settings and alterations, meter readings, and test results. The work being done is described as *you're doing it,* with the recorder doing the "writing." Subsequent playback of the tape, and written transcription to a notebook or log if required, may be helpful in interpreting and analyzing results and in learning from past mistakes.

Technical considerations. Authentic high-fidelity sound reproduction isn't a necessity in a ham shack recorder, though a few requirements *do* exist. The recorder should be of reasonably good quality (not a child's toy, to be sure), feature low distortion, have an auxiliary input for direct connection to the receiver's speaker, and include a recording level meter and tape counter. A "pause" or "edit" control is also a desirable feature. Requirements are tighter if the unit is going to be used to record SSTV signals or interface with a microcom-

puter; in these cases, a top-quality recorder having low wow and flutter should be selected. Other desirable, though not absolutely essential, features include a monitoring and/or auxiliary speaker jack, public address (PA) mode, automatic shutoff or track reverse, and fast forward and reverse capability. A monophonic unit is fine; there is little advantage in using a stereo unit.

Several tape formats are suitable: eight-track, reel-to-reel, and cassette. The eight-track recorder, operating at 3-3/4 ips, uses 1/4-inch tape in a track configuration that allows eight mono channels or four stereo channels to be recorded. Since the cartridge is actually an endless tape loop, it will run continuously if left to play out. Very short length cartridges are available, making this format excellent for phone CQs and even short SSTV "takes." The eight-track format does have its drawbacks, however, in terms of less-than-optimum audio quality, a tendency for tapes to become jammed internally, and the objectionable "click" and momentary loss of audio when tracks are switched.

The open-reel recorder is hard to beat for quality. Its distortion figures and frequency response are best among the three formats. Various combinations of reel size, tape length, speed, and available accessories add up to maximum versatility and flexibility. Recorder mechanical design is relatively straightforward (when compared with eight-track and cassette models), and maintenance is less difficult and costly to perform. However, the open-reel recorder—at least a good one—is expensive, and tapes are not as convenient to use as in the other two formats, manual tape threading being required on most models.



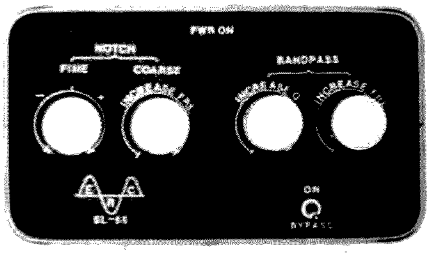
Tape recorders find many useful applications in the ham shack. A growing use is connection with digital microcomputers, where they are used for loading and recording of cassette programs and data. Radioteletype (RTTY) and Morse code interfaces are available from several sources for popular home computers such as the Apple, PET, and TRS-80, shown here. In addition to the basic program-loading function, the recorder can be used to digitally record on-the-air transmissions and to prerecord outgoing messages (including "brag tapes") for later broadcast. (Photo courtesy of Radio Shack)

The cassette machine is the most popular for ham shack use today, for reasons of relatively low cost, operating convenience, and steadily increasing quality. The cost of a small cassette unit is certainly not prohibitive, with usable machines available for as little as $25 to $30. Even high-quality monophonic portables come in at less than $100. The ever-increasing popularity of cassette machines is due in large measure to the ease with which tapes can be selected, loaded, recorded, and removed from the recorder, features that are very attractive for station use. Tapes in practically any length can be obtained for recording periods up to 120 minutes or more, using the standard cassette speed of 1-7/8 ips. The biggest disadvantages are that cassette editing isn't practical, the low tape speed mitigates against top quality recording, and accurate cueing is difficult. Most portable machines have an audio response that is entirely adequate for ham-band and shortwave signal reproduction, however.

An SSTVer, I opted for the Superscope C-104, a very high quality mono portable that includes such desirable features as cueing capability, pause control, nicad operation, built-in condenser mike, PA function, and variable tape speed. The front-panel controls and meter make it especially convenient for stacking above the station speaker or receiver—you don't have to look down on the recorder to operate it, as one must do with most small portables.

Standard front-loading stereo decks offer excellent potential though probably represent an overkill in quality. A stereo deck or recorder obtained at a reasonable price could likely be put to good use in the shack, though the second channel would be wasted. The micro-cassette recorders also offer good possibilities. Many of these units are quite small, can be operated vertically, and thus can be sandwiched in between equipment units on the operating console.

In using a recorder in your station, you may experience trouble with rf pickup, making it unusable when transmitting. The problem can be acute in solid-state units and comes about because of audio rectification of your signal by the set's amplifier stages.



ERC SL-55 audio filter is said to improve SSB and CW reception under severe conditions. The unit contains three separate filters: independent and continuously-adjustable bandpass filters as well as a fixed low-pass filter that can be cascaded with the others. The unit generates 1 Watt of audio and has an input/output impedance of 8 Ohms. (Photo courtesy of Electronic Research Corporation of Virgina)

Simple RFI-preventive measures, such as installing an rf choke and bypass capacitor in the recorder's mike and/or auxiliary input leads and bypassing the audio output leads and ac line, will often do the trick, unless you have a very poor station ground or are using a voltage-fed antenna that produces an inordinate amount of stray rf in the shack.

Various patch cords, connectors, switches, and jumpers may be required to conveniently use the recorder with your equipment; these only can be determined after deciding which functions the recorder is to fill. Using shielded cable for all audio connections should go a long way in reducing rf feedback, noise, and hum pickup.

Audio Filters

The congestion on the amateur bands has placed a premium on receiver/transceiver selectivity. Simple fixed-bandwidth i-f crystal filters were good enough for the 40s and 50s, but not good enough to adequately handle present-day QRM conditions. Densely-packed and overlapping SSB stations, closely-spaced CW signals, and RTTY reception through potentially obliterating heterodynes demand complex i-f filters or other means of achieving a high level of receiver selectivity.

Many upper-end receivers of 50s and 60s vintage contained special i-f circuitry using double-conversion techniques to allow the operator to peak the desired signal or null out an offending one. At the time, the best way to improve selectivity on inexpensive receivers was to add an outboard i-f-stage "Q-multiplier," which enabled the operator to either peak a desired signal or null out an offending one by manipulating one of several panel controls. The Q-multiplier (the best-known being Heath's QF-1) was capable of doing a good job, but some practice was required in using it. It went out of favor as the once-standard 455 kHz i-f frequency was largely abandoned for higher and lower i-f frequencies in double-conversion configurations. The transition from tube to solid-state designs also had a lot to do with the Q-multiplier's demise.

The basic means of attaining the desired amount of receiver selectivity today is by means of an i-f stage crystal or mechanical filter. Most high-quality transceivers use a filter with a steep shape factor to reduce out-of-passband signals and noise; the same filter is usually used on transmit. If your receiver or transceiver has provisions for optional i-f filters for reduced-bandwidth SSB and CW reception, it's a wise investment to obtain them—especially the CW filter. Some manufacturers, such as Kenwood, also offer provision for adding a second (dual) SSB filter assembly to further sharpen the response curve and improve the i-f stage's signal-to-noise (S/N) ratio. Addition of the second filter also has a beneficial effect on transmit, allowing a greater degree of speech compression to be used without a significant increase in sideband splatter and resultant bandwidth.

While most i-f filter arrangements don't offer true single-signal reception, those receivers and transceivers that have provision for shifting the center frequency of the i-f crystal filter (variously known as i-f-shift or passband tuning, depending on the manufacturer) offer additional possibilities for minimizing QRM and further improving overall S/N ratio.

Even in those sets having adequate i-f filtering, the addition of an audio filter can enhance performance. The audio filter acts in two ways: 1) It cuts down on the wideband noise generated by the set's i-f chain, preventing amplification by the set's audio stages, and 2) it further narrows the receiver's overall response curve, often allowing true single-signal reception. Both characteristics significantly aid reception when the QRM level is up and when working under weak-signal conditions.

Passive audio filters. A fixed-tuned, passive (non-amplifying) audio filter can do a great deal to improve the selectivity of a receiver, especially one without an i-f filter; in some inexpensive sets, an audio-stage filter is the *primary* selectivity-determining device. Many hams found that war surplus radio range filters inserted in their radios' headphones lead did a good job in separating closely-spaced CW signals, though the filter frequency of most of these units was a bit high-pitched to suit many and receiver tuning and stability became critical when using very narrow bandpass filters.

More sophisticated designs have been developed over the years, using large fixed-value inductors to achieve the desired degree of selectivity at audio frequencies. The radio handbooks are full of good passive filter designs, especially for use on CW. A particularly good one is the six-element L/C CW bandpass filter designed by Ed Wetherhold W3NQN. It appears on page 8-27 of the 1980 ARRL *Radio Amateur's Handbook*. Other W3NQN designs appear in the December, 1980, *QST*. Another practical filter approach is that of Del Crowell K6RIL that appeared in the March, 1968, *CQ Magazine* in his article, "Adding CW Selectivity for Transceivers."

Passive filters are brute-force devices, however; they are lossy—very noticeable if one wants to drive a loudspeaker. Though easy to build, the passive devices rely on large, cumbersome and often hard-to-find toroidal inductors. Also, there is no flexibility in setting the center frequency and bandpass curve or changing these characteristics during operation. A far more satisfactory approach lies in the use of the *active* audio filter.

Active audio filters. The active, or tuned, amplifying audio filter uses RC networks in conjunction with solid-state amplifiers to *synthesize* the inductor characteristics. The simulated inductance is resonated with a capacitor to produce a tuned-filter effect. What makes this kind of filter so popular with hams is that the filter can be constructed with variable Q and variable center and cutoff frequencies; this allows convenient front-panel control of the filter's operating characteristics that the operator can precisely tailor to suit his mode of operation, personal preferences, and band conditions.

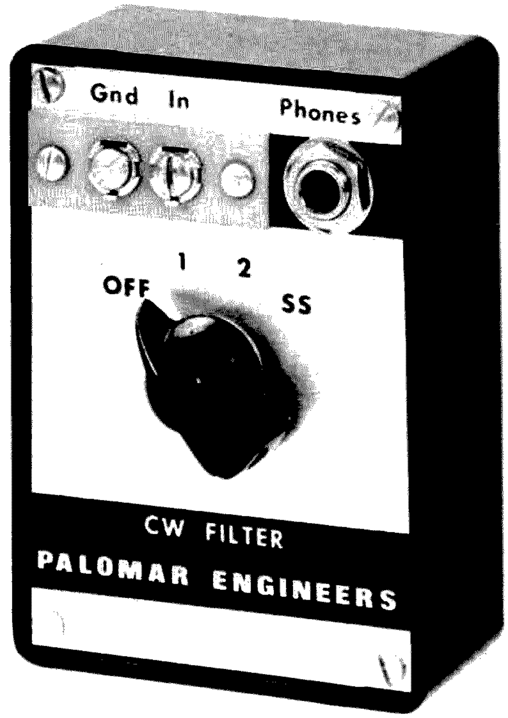
The current spate of solid-state active filter designs are descendants of the classic National Radio "Select-o-Ject" audio filter that was immensely popular about 30 years ago. This tube-type accessory was a handy, quick-and-dirty supplement to a receiver having little real selectivity. Present-day active filters offer a number of specialized features that make them of great interest to both CW and SSB operators.

An active audio filter can be built from one of the many designs regularly featured in the ham magazines; several are in the *Handbook*. At least a dozen firms sell these very cost-effective QRM-suppressors that allow even a modest receiver or transceiver to come to life in the selectivity department, particularly on CW. Manufacturers include Autek Research, Kantronics, M&M Electronics, Datong, Electronic Research Corp. of America, Palomar Engineers, MFJ Enterprises, and several others.

Typical handbook and commercial designs enable operation on either CW or SSB, though a few less-expensive filters are for CW-only or SSB-only use. The majority are self-contained and include their own power supply or draw power from the receiver or transceiver's accessory jack. Most are connected to the set's audio output jack and contain a small internal audio power amp to directly drive a speaker or headphones. The filters enable the operator to adjust selectivity from a few Hz, for razor-sharp CW performance, up to a completely flat response. Many have separate high-pass and low-pass operating modes, especially useful on SSB; others have a deep notch feature that is used to null out an interfering signal or heterodyne without degrading the desired signal. A few sophisticated models allow dual (simultaneous) notching and filtering; at least one model contains a built-in noise limiter.

Using the active filter on SSB is a gratifying experience, especially if in conjunction with a modest set—though top-of-the-line models will benefit as well. By proper control-knob manipulation, it's possible to dramatically improve signal readability under conditions of QRM, static, splatter, and the like—reducing operator fatigue and making listening a great deal more pleasant. SWLs, 10-meter AMers, and CB operators should be interested in the capabilities of the active audio filter, too. Selectivity on the crowded AM shortwave and standard broadcast bands is considerably improved, and stations just a few kHz apart can be separated with little cross-channel interference.

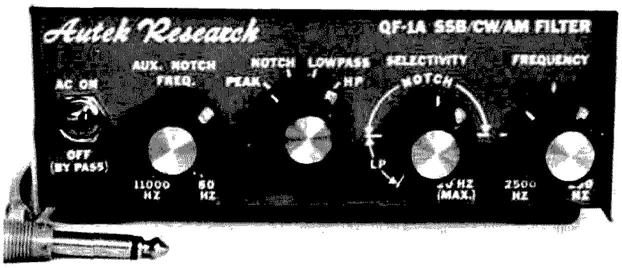
The real thrill comes when using one of these filters on CW. Used in conjunction with a set's existing CW i-f filter, results can be truly impressive. With the active filter, the desired signal can be peaked with



Palomar Engineers' CW filter connects between the receiver and a set of stereo headphones. There are actually two filters, a narrowband one with an 80-Hz bandwidth (centered at 800 Hz) and a wideband one that cuts out hum and high frequency interference but passes most of the receiver audio signal. The narrowband signal goes to one ear, the wideband to the other, giving simulated-stereo reception. The effect is to offer a signal "mix" that is an improvement over either filter alone: The off-frequency signals appear in one headphone, the desired signal in both. The operator's mind concentrates on the desired signal and rejects the interference. Long operating periods are said to be less fatiguing using such an arrangement. (Photo courtesy of Palomar Engineers)

an effective bandwidth measured in *tens of cycles,* even in the presence of close-by strong signals that have managed to bull their way through the radio's i-f strip. Even with a sharp i-f CW filter installed, it's possible to actually *tune through* the set's i-f passband with the audio filter and discover several individual CW signals that can be brought up to solid-copy levels that were unreadable or scarcely detectable without the filter. Of course, there is a limit to the degree of selectivity one can crank in; with too much selectivity, filter "ringing" becomes objectionable. Also, using the notch feature, very pronounced unwanted signal rejection (sometimes 70 dB or more) can be attained by proper control manipulation.

Space-age filtering. A couple of takeoffs on active filtering techniques have surfaced in recent years. One is the concept of simulated-stereo reception,



An "outboard" active audio filter can yield surprising performance benefits in conjunction with even the most expensive receiving equipment. Assuming such a filter is used with a receiver or transceiver having reasonably good i-f selectivity with good "skirts," weak and QRM-plagued SSB signals can be made to "jump out of the noise" in many cases. And in the sharpest modes, several CW signals may be copied within the set's passband and tuned in separately. Autek filter shown here is based on a design pioneered by the firm in 1972. (Photo courtesy of Autek Research)

described by Max Blumer WA1MKP in his October, 1974, *Ham Radio* article, "Enhancing CW Reception Through a Simulated Stereo Technique." In this approach, an active filter is used. Unprocessed receiver audio is fed to one ear, and filtered (processed) audio is fed to the other ear. This technique allows you to read slightly off-frequency CW stations while simultaneously hearing the desired signal, in the clear, in the other ear. The brain does the ultimate filtering—it "hears" all the signals, but the processed signal stands out solidly, with the others mentally rejected. The bottom line is that the filter allows greatly improved reception of the desired signal, but also allows you to hear off-frequency replies to your CQs; it's also easier to scan the band using the simulated-stereo technique. A stereo headphone is required for this type of filter, which is offered commercially by both Palomar Engineers and MFJ.

Especially interesting is the automatic-tracking audio filter offered by Datong. In addition to some impressive narrowband tuning capabilities, the FL-1 frequency-agile audio filter features fast automatic suppression of interfering heterodynes in the range of 280 to 3000 Hz by means of its search-lock-and-track notch filter. The tracking notch can be left in the circuit with no audible effect until a whistle appears; the circuit then goes after it and will suppress it within 1 second.

How does it work? Two phase-sensitive detectors control signals used for automatic tuning. One produces a voltage proportional to the degree of mistuning, and the other produces a logic level indicating the presence of a signal within the filter passband. In the absence of such a signal, the integrator becomes a sweep generator. But when a signal is detected, the sweep stops, the unit's lock lamp illuminates, and the integrator becomes part of an automatic frequency control (afc) negative feedback loop. The filter then remains locked to the "captured" signal and will track it, if required, throughout the filter's range of 280 to 3000 Hz. This capability allows the routine use of an extremely narrow (20 Hz) notch which does not noticeably affect received signals and which would be nearly impossible to manually tune and maintain in tune. Of interest to CW ops, an attenuated afc voltage is also used in the manual tuning mode to allow the filter to automatically track *drifting* CW signals over a 100-Hz range!

Whether you opt for a simple or complex filter, you'll likely be glad you made the investment. Dollar-for-dollar, an audio filter is one of the best accessory aids you can buy for your receiver or transceiver.

Wrap-Up

In this article, we have discussed a wide range of basic, yet important, phone-jack accessories: headphones, speakers, recorders, and filters, with a view to obtaining maximum usefulness from dollars spent on station equipment. For most hams, this group of reception accessories probably represents the most important initial accessory investment. For this reason, and for space limitations, we've not discussed exotica which might otherwise fit the article's "phone-jack" scope, such as SSTV viewers, RTTY/Morse decoders, monitorscopes, phone patches, and the like. We'll reserve discussion on these "second-level" accessories until a later time.

In the final analysis, *you* must decide which, if any, accessories to build or buy. Hopefully, the criteria, suggestions, and observations provided in this article will help make your decisions both logical and wise. ■

Further Reading

The following reference sources provide additional information, theory, and construction details. Several contain further references to other information sources you may wish to consult:

Jim Ashe, "How to Use Hi-Fi Headphones," *Popular Electronics*, July, 1972.

Ronald M. Benrey, "Adapting Stereo Phones for Hams," *Electronics Illustrated*, May, 1972.

Fred Blechman K6UGT, "How to Use a Tape Recorder In Your Shack," *Electronics Illustrated*, July, 1962.

Max Blumer WA1MKP, "Enhancing CW Reception Through a Simulated Stereo Technique," *Ham Radio*, October, 1974.

Len Buckwalter, "CB Scene" column in *Popular Electronics*, May, 1974.

Richard Humphrey, "Accessories for Your CB Rig," *Popular Electronics*, October, 1973.

Del Crowell K6RIL, "Adding CW Selectivity for Transceivers," *CQ Magazine*, March, 1968.

James R. Kates WB8TCC, "Put a Tape Recorder to Work in Your Shack," *CQ Magazine*, December, 1977.

The Radio Amateur's Handbook, Newington, Connecticut, American Radio Relay League, 1980 edition.

Charles Schauers W6QLV/4, "Ham Clinic" column in *CQ Magazine*, May and June, 1961.

Karl T. Thurber, Jr. W8FX, "Ham Shack Accessories: What You Really Need," *Ham Radio Horizons*, December, 1979.

Karl T. Thurber, Jr. W8FX, "Hi-Tech Gear for Hams and SWLs," *Popular Electronics*, August, 1980.

William G. Welsh W6DDB, "Headsets and Ham Radio," *73 Magazine*, February, 1972.

Edward E. Wetherhold W3NQN, "Modern Design of a CW Filter Using 88- and 44-mH Surplus Inductors," *QST*, December, 1980.

OSCAR ORBITS

- The Amsat Software Exchange has recently been formed and is now accepting orders. The first program being made available is the orbital prediction program written by Dr. Tom Clark W1IWI. It is available for most popular machine environments, with other versions being developed. Presently available are TRS-80 disk and cassette versions, Apple/II diskette, Microsoft BASIC, and PL/I-80. This program will accommodate the elliptical orbit tracking required for the Phase III satellites. For complete information on versions available as well as new additions and ordering information, send an SASE to: AMSAT Software Exchange, Box 338, Ashmore IL 61912.
- The early months of amateur radio's newest satellite, UoSAT-OSCAR 9, were full of developmental work. The Surrey, England-based ground crew concentrated on generating and relaying to the bird a computer program that will allow the craft to stabilize itself via on-board torquing coils and a gravity gradient boom. Once this is accomplished, the experimental part of the mission will commence.
- AMSAT, the people who organize ham radio's space communications program, received a "royal boost" from JY1, Jordan's King Hussein. While visiting the US in early November, the King expressed his support to AMSAT President Tom Clark W3IWI.
- Although the AMSAT financial picture has been brightened by several large donations, there is still a need for grass-roots support by the entire ham population. You can find out more about AMSAT by writing to: The Radio Amateur Satellite Corporation, PO Box 27, Washington DC 20044.

Information for this column comes from the *AMSAT Satellite Report*.

OSCAR 8 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
19928	1	0045:59	79.1
19942	2	0050:31	80.2
19956	3	0055:03	81.4
19970	4	0059:35	82.5
19984	5	0104:07	83.7
19998	6	0108:39	84.9
20012	7	0113:11	86.0
20026	8	0117:43	87.2
20040	9	0122:15	88.4
20054	10	0126:47	89.5
20068	11	0131:19	90.7
20082	12	0135:51	91.8
20096	13	0140:22	93.0
20109	14	0001:43	68.4
20123	15	0006:15	69.5
20137	16	0010:47	70.7
20151	17	0015:18	71.8
20165	18	0019:50	73.0
20179	19	0024:22	74.2
20193	20	0028:53	75.3
20207	21	0033:25	76.5
20221	22	0037:56	77.6
20235	23	0042:28	78.8
20249	24	0046:59	80.0
20263	25	0051:30	81.1
20277	26	0056:02	82.3
20291	27	0100:33	83.4
20305	28	0105:04	84.6

OSCAR 9 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
1776	1	0131:01	157.0
1791	2	0120:57	154.5
1806	3	0110:54	152.0
1821	4	0100:50	149.5
1836	5	0050:47	147.0
1851	6	0040:43	144.5
1866	7	0030:39	142.0
1881	8	0020:36	139.5
1896	9	0010:32	136.9
1911	10	0000:29	134.4
1927	11	0125:45	155.8
1942	12	0115:41	153.3
1957	13	0105:38	150.8
1972	14	0055:34	148.2
1987	15	0045:30	145.7
2002	16	0035:27	143.2
2017	17	0025:23	140.7
2032	18	0015:20	138.2
2047	19	0005:16	135.7
2063	20	0130:32	157.0
2078	21	0120:29	154.5
2093	22	0110:25	152.0
2108	23	0100:21	149.5
2123	24	0050:18	147.0
2138	25	0040:14	144.5
2153	26	0030:11	142.0
2168	27	0020:07	139.5
2183	28	0010:04	137.0

OSCAR 8 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
20319	1	0109:35	85.7
20333	2	0114:07	86.9
20347	3	0118:38	88.1
20361	4	0123:09	89.2
20375	5	0127:40	90.4
20389	6	0132:11	91.5
20403	7	0136:42	92.7
20417	8	0141:13	93.8
20430	9	0002:33	69.2
20444	10	0007:04	70.4
20458	11	0011:35	71.5
20472	12	0016:06	72.7
20486	13	0020:37	73.8
20500	14	0025:07	75.0
20514	15	0029:38	76.1
20528	16	0034:09	77.3
20542	17	0038:40	78.5
20556	18	0043:10	79.6
20570	19	0047:41	80.8
20584	20	0052:11	81.9
20598	21	0056:42	83.1
20612	22	0101:12	84.2
20626	23	0105:43	85.4
20640	24	0110:13	86.5
20654	25	0114:44	87.7
20668	26	0119:14	88.9
20682	27	0123:44	90.0
20696	28	0128:15	91.2
20710	29	0132:45	92.3
20724	30	0137:15	93.5
20738	31	0141:45	94.6

OSCAR 9 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
2198	1	0000:00	134.5
2214	2	0125:16	155.8
2229	3	0115:13	153.3
2244	4	0105:09	150.8
2259	5	0055:05	148.3
2274	6	0045:02	145.8
2289	7	0034:58	143.3
2304	8	0024:55	140.8
2319	9	0014:51	138.3
2334	10	0004:47	135.8
2350	11	0130:04	157.1
2365	12	0120:00	154.6
2380	13	0109:56	152.1
2395	14	0059:53	149.6
2410	15	0049:49	147.1
2425	16	0039:46	144.6
2440	17	0029:42	142.0
2455	18	0019:38	139.5
2470	19	0009:35	137.0
2486	20	0134:51	158.4
2501	21	0124:47	155.9
2516	22	0114:44	153.4
2531	23	0104:40	150.8
2546	24	0054:37	148.3
2561	25	0044:33	145.8
2576	26	0034:30	143.3
2591	27	0024:26	140.8
2606	28	0014:22	138.3
2621	29	0004:19	135.8
2637	30	0129:35	157.1
2652	31	0119:31	154.6

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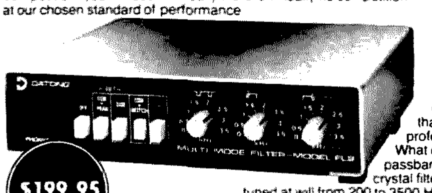
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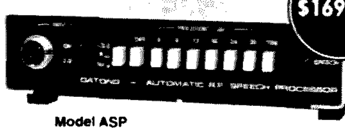
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Model ASP: The "smart" rf speech processor
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A Dish Antenna Anyone Can Build

—no hyperbole, just a parabola

Michael Brown W8DJY
6297 Brown Run Road
Middletown OH 45042

Are you contemplating the challenge of operating on the amateur microwave bands? What about getting in on the excitement of receiving satellite TV signals? These and similiar projects usually require a dish-style antenna. You could buy one or, better yet, you can build one. This article will tell you how.

I wanted to put a signal on the 1296-MHz band. To do the job right, I needed a dish antenna. I took the plunge at a hamfest, buying a surplus military job made of spun aluminum, about 6 feet in diameter. It was one of those good deals you can't pass up.

Now my "good deal" sits in the corner collecting dust, waiting to be sold at the next hamfest. I managed to get a signal on 1296 using a dish two meters in diameter that I built myself. The design is one which uses easily-obtained materials and has a total cost of less than $100. Best of all, it need not be a long, involved project. In fact, you can build a dish like mine in a single weekend.

Photos by Tim Daniel N8RK

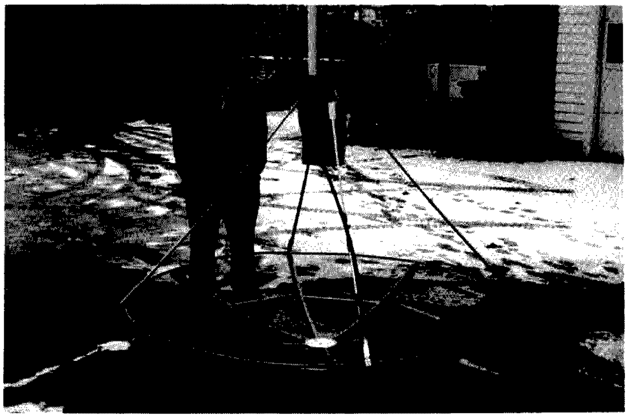


Photo A. The finished dish is light enough to be moved easily; the author stores his away each winter.

Some Theory

Before we jump into the details of construction, it would be a good idea to look at the basics of dish design. The dish, resembling an oversized child's snow saucer, is a paraboloid. Its unique geometric properties cause it to collect a beamwidth of energy from a distant source and reflect it to a central point known as the focal point, or focus. Similarly, a signal radiated towards the dish from the focus will be effectively radiated by the antenna.

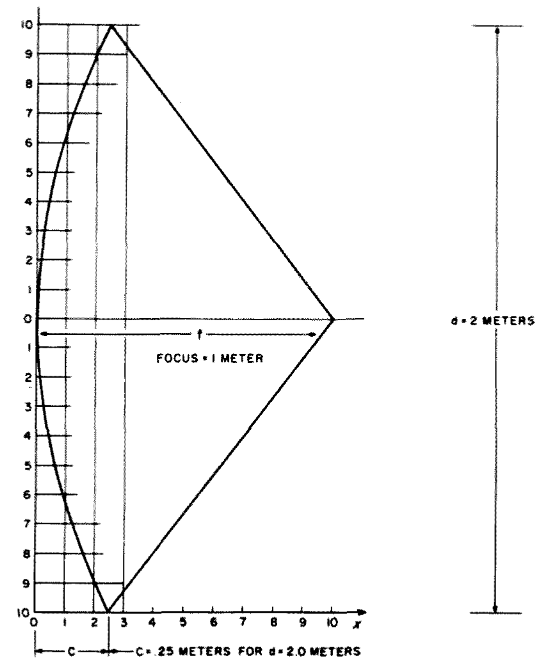
The important dimensions of a paraboloid are shown in Fig. 1. The reason my "good deal" dish turned out to be a piece of junk was that the relationship between the focal point and the diameter was all wrong.

Known as the f/d ratio, this relationship is very important when it comes time to feed the dish. Experience shows that dishes with f/d ratios of 0.5 and greater can be fed easily with a horn-style array. (My commercial dish's f/d ratio was about 0.25 and was difficult to feed.)

The diameter (d) is important in determining how much gain the antenna will have. Obviously, a dish 6 feet in diameter will collect more signal than a 3-foot dish. Each time you double the diameter, the gain increases by a factor of four (6 dB). The actual gain of a dish depends on its efficiency and the frequency it is used on. Assuming a reasonable efficiency of 50%, a 2-meter dish should have about 25 dB of gain over a dipole source at 1296 MHz. The 3-dB beamwidth will be about 8 degrees. Fig. 2 shows these relationships.

Once you have chosen the desired diameter, you'll know where the focal point should be to achieve an f/d ratio of about 0.5. In the case of a 2-meter dish, f will be at one meter.

The exact curvature needed to obtain a paraboloid with the desired focus and diameter can be found using the equation $y^2 = 4fx$. By calculating a number of points for x and y, you'll have an accurate plot of the shape required. Let's try an example for a dish with the focus at one meter: The x value corresponding to the y point of 0.5 is found by solving the equation $0.5^2 = 4(1)x$. A little algebra yields: $x = 0.5^2/[4(1)]$.



$$y^2 = 4fx$$

y = 1, x = .25
y = .9, x = .2025,
y = .8, x = .16,
y = .7, x = .1225
y = .6, x = .09

y = .5, x = .0625
y = .4, x = .04
y = .3, x = .0225
y = .2, x = .01
y = .1, x = .0025

Fig. 1. Dish dimensions. Width (c) is found by solving: $f = d^2/16c$.

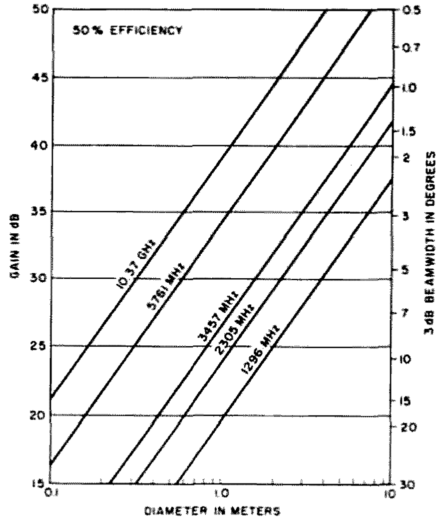


Fig. 2. Dish diameter/gain relationship.

Punching the calculator keys, we come up with the answer x = 0.625 meters. Fig. 1 also shows that the total width of the dish, c, is found with the equation $f = d^2/16c$.

That's all there is to designing the reflective part of the dish. Now let's look at how to build it. For starters, you should be prepared to work with metric measurements of length. I found that the use of meters and centimeters helps to ensure accurate results. For noncritical measurements, we'll refer to English units.

Once you have a set of x and y values, it is time to fabricate a surface that accurately depicts them. Any irregularities will impair the antenna's gain. At 1296 MHz, deviations of up to 1.5 cm are tolerable. As the frequency increases, this tolerance decreases. Using care, this dish can be built with deviations of less than 0.5 cm.

Making the Ribs

The structural elements that give the dish its strength and special shape are eight wooden ribs. I made mine from scrap 3/4-inch white pine. Each rib was cut from a 40″ × 14″ piece. Any available substitute should work, provided that it is reasonably light and can be cut to the needed shape.

Carefully draw a center line lengthwise, 5.8 cm from one edge of the board, as shown in Fig. 3. Work from this line to lay out a parabola, using the points generated by the $y^2 = 4fx$ equation. The more points you use, the more accurate your paraboloid will be. Carefully draw a line to connect the points on the inner surface. The outer surface should have a shape like the one shown. The lower flat edge will be at the center of the dish, while the upper end will be at the edge, fastened to a ring of aluminum tubing.

After checking the layout, the eight ribs can be rough-cut to about 0.2-cm accuracy using a band or saber saw. Final trimming should be done by sanding. Be sure to keep the flat edge parallel to the center line.

The ribs are all joined at the dish's center by a 3/4-inch-thick plywood mounting plate like the one shown in Fig. 4. Ribs A and B are mounted first, using 1-1/2-inch wood screws. All the other ribs must be shortened to obtain equal inside diameters. Ribs C and D have 3/8″ removed from the inside end. Ribs E, F, G, and H are shortened 3/8″ and mitered with two 45° angles as shown in Fig. 4(a).

Finally, all the remaining ribs are fastened to the mounting plate, first with glue and then with wood screws.

To add strength to the dish's outer edge, I encircled it with 1/2-inch aluminum tubing. Four six-foot lengths were used. To bend the tubing into a circle, one end is plugged, then the tube is filled with sand and carefully bent into shape. This was easier to accomplish than I thought it would be. An undersized piece of tubing is used for coupling between the sec-

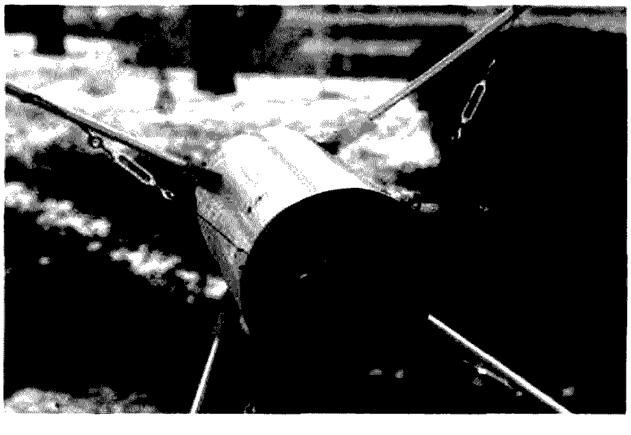


Photo B. A feedhorn can be easily constructed. The pickup is a simple, monopole element.

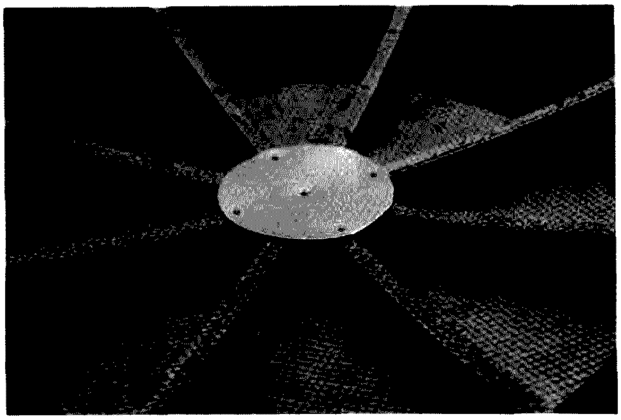


Photo C. A circular plate holds the reflective screening in place at the dish's center.

tions. The shaped lengths are fastened to the dish perimeter with 5-cent conduit clamps as shown in Fig. 4(b). Since the ribs give the dish its shape, getting the outside circle perfect is not necessary.

Covering the Frame

The next step is to cover your frame with a reflective surface. I used 1/4-inch hardware cloth because it was cheap and available. To make the job easier, I cut the cloth into eight slightly oversized triangles. Staple a triangle between two adjoining ribs and then trim the excess outer edge to size. Next, tie-wrap the perimeter to the aluminum tubing using nylon cord with cable-wrapping technique. Be sure to wear gloves when working with the hardware cloth.

Once all the screen is in place, eight flathead screws are used to hold it on each rib. (The staples are no longer needed and can be removed.) Since eight layers of hardware cloth overlap at the center, they must be trimmed and then securely fastened beneath a seven-inch diameter disc.

At this stage, all the essential parts of the reflector are complete. Since my dish is going to be mounted in an exposed location, I decided to strengthen it by adding bracing between the ribs about midway from the center. A framework was fastened to the center plate so that the whole antenna can be bolted to a mast.

Feedhorn Ideas

Because of the f/d rati of 0.5, the obvious fee choice becomes a horn. The theory behind horn design is not trivial. To make matters worse, there often is a vast difference between a design on paper and one that works. The horn shown in Fig. 5 has been field-proven on the 1296-MHz band by K9KFR and others. Horns of this type have about 8 dB of gain. Other types of feeds can be used; one good source of information is the RSGB book, *VHF-UHF Manual*, by Jessop and Evans.

Unless you can find a tin can that meets the dimensions shown in Fig. 5, you will need to make one. Using light-weight aluminum stock, I made a cylinder from a 18" × 28.25" piece. Next, a cap is fashioned to fit into one end. Small vee-shaped tabs are bent 90° and riveted to the cylinder wall. The result is a tube with an inside length of 16" and a diameter of 9".

The location of the tuned element is critical. A type-N connector should be mounted 2" from the rear wall. A 1/4-wave driven element (1.8" of 1/4-inch copper tubing or 1/8" welding rod) is adjusted by filing. Using approximately one Watt of power with an in-line wattmeter, file for best vswr. *Caution: The horn is emitting microwaves; keep hands and eyes away from the opening.* Be sure to use hardline for all connections.

It should come as no surprise that at this point the antenna is almost finished. Now the horn is mounted on the antenna frame with four sections of telescoping aluminum tubing.

The exact distance between the dish center and the horn must be found experimentally. The focal point will *not* be at the horn's outside edge, it will be inside the cylinder. To find the exact focus, the dish should be aimed at a signal source and the horn moved up and down until the received signal is at a maximum. If your 1296 receiving gear includes a low-noise amplifier, then one excellent signal source is "sun noise." Aim the dish at the sun, and your receiver should give a noticeable output.

The antenna's polarity is determined by the position of the driven element. Rotating the horn 90° changes the antenna from vertical to horizontal or vice versa. When the driven

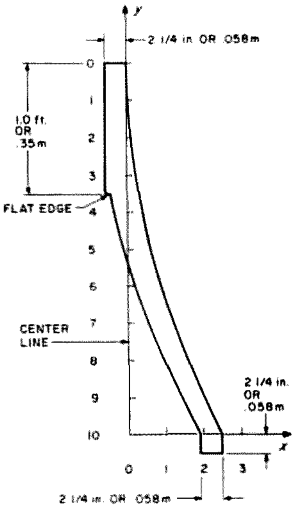


Fig. 3. Rib detail.

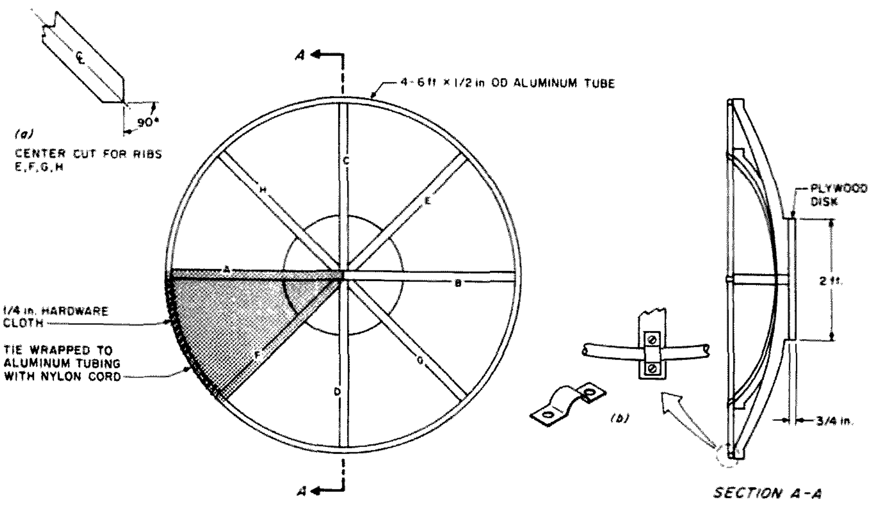


Fig. 4. Assembly of the ribs.

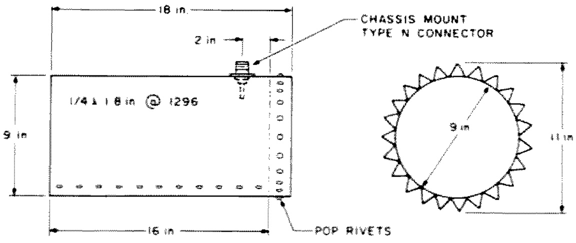


Fig. 5. Feedhorn design.

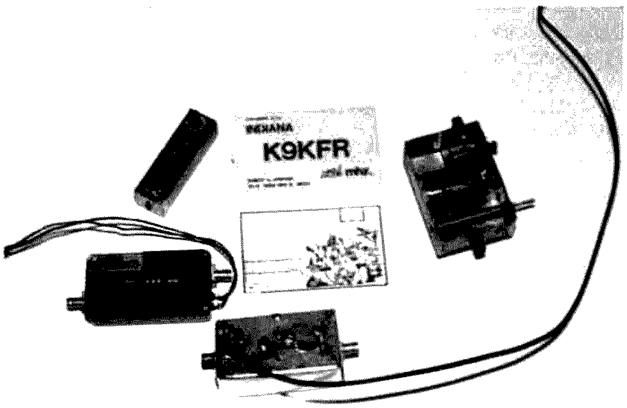


Photo D. Building a 1296-MHz dish need not be difficult, but it will require some home-brewing.

element is horizontal relative to the Earth, the antenna is horizontally polarized and is set for 1296-MHz tropo operation. Once the focus and polarity are set, bolt everything into place and start enjoying your new antenna.

Life on 1296

You might be interested in the rest of my 1296-MHz station. For receiving, I use a preamplifier made with an MRF901 transistor, followed by a Microwave Module that converts the signal to 28 MHz where an amateur transceiver is used. On transmit, a home-brew varactor tripler provides 3/4-Watt output on 1296 when driven with a ten-Watt, 432-MHz signal. This may not seem like much power, but I make the most of it by using hardline between the dish and the shack. Thanks to my dish antenna, the 1296 effort has been a success. The first two contacts were with K9KFR and WA8JHW, each more than 100 miles away.

This article is being written in the winter, and the dish has been stored away, safe from ice and other hazards. When warm weather returns, you can be sure that W8DJY will be back on 1296. In the meantime, plans are being made for a much bigger dish and a more powerful transmitter.

As you can see, building a dish need not be difficult. This project was the result of a lot of help and ideas from fellow VHF-UHF enthusiasts, including WB8EEX, whose garage proved invaluable, W8ULC, who handled the fancy footwork on the tower, and K9KFR, who patiently helped get a feed that worked.

About the only thing that can't be changed is the basic parabolic shape. Make the most of the materials that are available in your area; be brave; experiment! If you have questions, please include an SASE. See you on 1296! ■

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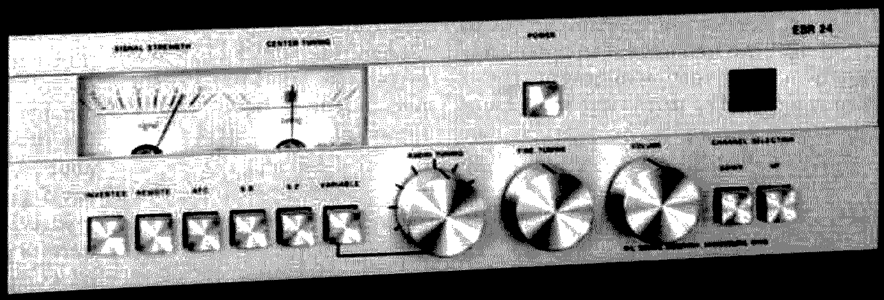

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Job's Own LNA

– rolling your own takes patience

Yes, it *is* possible to home-brew a workable LNA (Low Noise Amplifier) for your home-brew satellite TV receiver! But to do it, you must have the patience of Job and start with a full head of hair!

We'll let you, the reader, decide as you read the article just how much patience we have.

In ham radio receiver terms, the LNA is the "front end" of the satellite receiver. Commercial units generally have about 40 to 50 dB of gain at 4 GHz. They usually are constructed of one or two stages of GaAsFET transistors and several stages of bipolar transistors to achieve the amplification desired. The GaAsFET transistors are a special type of transistor with a very low noise figure. They get their name from the material used to achieve the low-noise figure, gallium (Ga) arsenide (As).

This article describes the trials and tribulations that we went through in building the LNA for our satellite-TV receiving system. Although we had access to absolutely no test equipment for 4 GHz until after it was known to be working, we were very successful in getting the complete system going. We wish to share our hard-earned information with *73* readers who are considering building their own systems.

First, a little history. Our initial attempt to build an LNA used a commercially-available board which, for reasons to be discussed, will be nameless. The board was supposedly designed to work with Nippon Electric Company (NEC) NE21889 GaAsFETs. These FETs are expensive at $103.25 for two, but they have a noise figure of 1.2 dB at 4 GHz.

So, being the scroungers that we are, we attempted to substitute cheaper (higher noise figure) GaAsFETs. The result was two blown FETs that cost $62.50 and two grown men crying. We then bit the bullet and ordered two of the NEC FETs from its US distributor, California Eastern Labs (CEL).

With cold, dry weather, we were in a real dilemma. How do you protect a hundred bucks worth of minute transistors from static electricity while you are soldering them into the circuit? We finally decided that we needed a work area with a good ground and high humidity. Richard's front bathroom was selected to be converted to a reduced static work area. We turned on the hot water in the shower to steam things up.

A piece of copper braid wrapped around my wrist and grounded to the cold water pipes provided the ground needed. A large piece of copper-covered PC board also was grounded to the cold water pipe and was used as the work surface. We let the soldering pencil

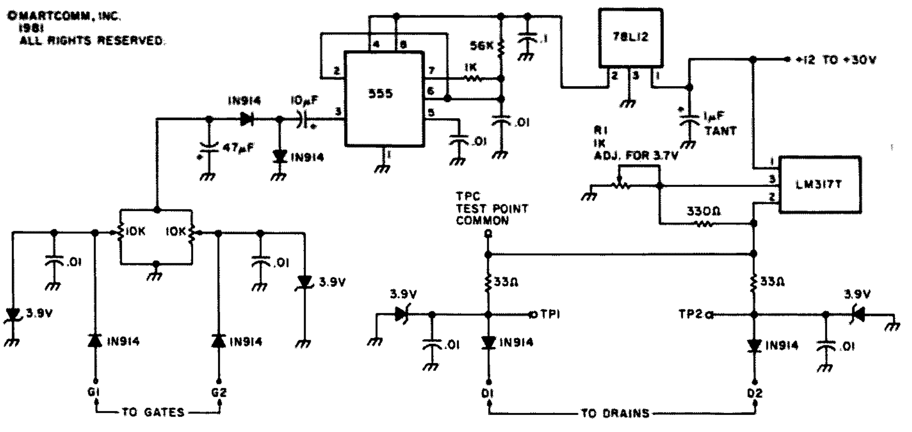


Fig. 1. Bias supply schematic.

heat up and then unplugged it from the ac line and grounded it with a jumper to the work surface for more static protection. I quickly soldered the first transistor in before the iron could cool. After I stopped shaking, we reheated the soldering pen and I soldered in the second transistor. It's amazing what lengths you will go to when a hundred dollars worth of FETs are at stake.

The LNA was mounted in a box made of double-sided PC board, with feedthrough capacitors supplying the correct operating voltages from a very simple resistive divider power supply. Next, we gave the LNA a try. It wailed like a banshee! In other words, it acted more like an oscillator than an amplifier.

How did we tell that it was oscillating without using test gear? We discovered that any oscillation within the 3.7-to-4.2-GHz band is immediately obvious on a TV connected to the receiver. If the oscillation is strong, there will be very prominent black bars on the screen regardless of where the local oscillator is tuned. If the oscillation is weak, there will be a very weak but still visible black bar. Black bars will occur twice, 70 MHz apart, within the tuning range of the local oscillator, if you are using a single conversion receiver (since you get both the signal and its image).

If the oscillation is outside the tuning range of the TV, however, it will not show up on the TV screen. If you can't see it on the TV and if you don't have a spectrum analyzer to test with, how do you know that it is still oscillating? Noise, noise, and more noise at the 70-MHz i-f stage.

What to do with the oscillating LNA? Start over! We wrote California Eastern Labs for their Application Note AN80903 that describes an LNA using the NE21889s. A prompt response from CEL brought it to us. In the CEL design, the LNA was mounted in a machined-brass enclosure. We could not immediately locate any half-inch-thick brass to make the enclosure, but Richard, scrounging through his junk pile, located a short piece of copper bus bar which was suitable. A little persuasion was applied to a local machine shop and presto, we had two nice machined-copper enclosures.

Since we thought it would be impossible to remove the GaAsFETs from the first LNA board without destroying them, we ordered two more NE21889s from CEL. At $103.25 for the pair, this project was getting expensive!

Richard arranged for a local print shop to make negatives for the printed circuit board to within .002 inch of the dimensions specified in the CEL Ap Note. We quickly made a board and waited for the second pair of transistors to arrive.

While waiting for the transistors, we did some serious thinking about a power supply for the LNA. As previously mentioned, we had already zapped two "cheap" FETs. We wanted a reliable LNA power-supply design that would protect the expensive little buggers. Many hours of design, building, and testing of circuits by Richard resulted in the LNA power supply board described here. We call it our "How Not to Gas Your FETs Bias Supply Board." It was designed specifically for a two-stage LNA using the NEC 21889 FETs.

Some criteria for the design: It should—

- Supply +3 volts for the drain and −3 volts for the gates.
- Power two stages of GaAsFETs.
- Require only one pair of wires for the LNA so the supply voltage, with proper blocking, could be carried on coax cable.
- Provide reverse polarity and overvoltage protection for all gates and drains.
- Regulate gate bias and drain voltage with a main-supply voltage falling anywhere between +15 and +30 volts.
- Have most parts available from Radio Shack.

The circuit described in Fig. 1 meets all of the design criteria. The input voltage, which can be from +15 to +30 volts, is applied to an LM317T adjustable voltage regulator, which reduces it to +3.7 volts. The +3.7 volts is then filtered by a 1-uF tantalum capacitor and fed through 33-Ohm current-limiting re-

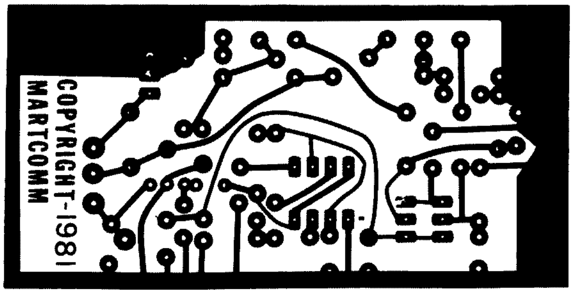


Fig. 2(a). PC-board layout.

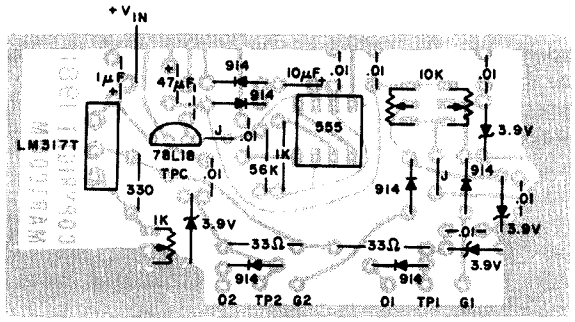


Fig. 2(b). Parts placement.

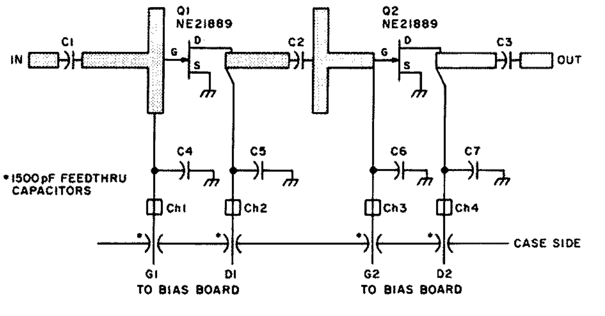


Fig. 3. Typical GaAsFET amplifier schematic.

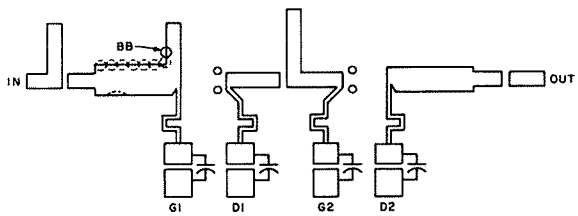


Fig. 4. Typical LNA board layout (not to scale).

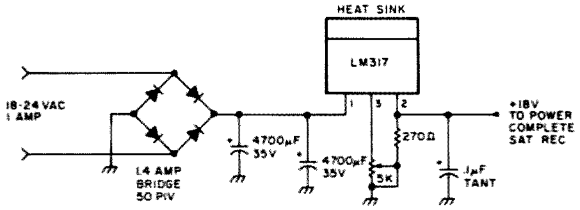


Fig. 5. Receiver power supply schematic.

sistors to the drains of the two GaAsFETs. The test points on each side of the 33-Ohm resistors are used to measure the voltage drop across the resistors and, therefore, the current being pulled by each FET. A voltage drop across the resistor of .33 volts equals 10 milliamperes of current being pulled by the FET. A 3.9-volt zener diode limits the maximum drain voltage, and high-frequency filtering is provided by the .01-uF capacitors. The voltage is then fed through 1N914 diodes for reverse voltage protection. This completes the drain supply.

We decided to generate the required negative voltage from the positive supply instead of going with a bipolar supply. Past experience has proved that for us, the negative-voltage regulator always fails first. With no negative bias, high-drain current would probably result, zapping the expensive FET. For the gate supply, the +15 to +30 volts is applied to a 78L12 regulator. The regulated +12 volts is used to supply a NE555 timer IC configured as a free-running multivibrator. The output of the 555 is rectified with a voltage doubler and filtered to give a negative voltage for the gate bias. The negative voltage is applied to two 10k-Ohm ten-turn pots. The zener overvoltage, diode reverse-polarity protection, and high-frequency filtering are the same as for the drain supply. A PC-board layout and parts overlay for the LNA power supply are shown in Fig. 2.

Everything was now ready for the arrival of the second pair of FETs. When they arrived, Richard soldered them in using a Radio Shack battery-powered, isolated-tip soldering pen that we had purchased for working with the GaAsFETs. By having Richard solder these in, we discovered that the guy who supplies the money for the FETs shakes the most when soldering.

After assembly of the bias supply board, but before connecting it to the LNA, apply +15 to +30 volts. With a voltmeter, adjust pot R1 for +3.7 volts at the test point TPC (Test Point Common). This will result in approximately +3 volts to the drains after the .7-volt drop across the reverse-polarity protection diodes. Set the 10k bias pots for −3 volts at points G1 and G2.

The supply is now ready for connection to the LNA, using the isolated-tip, battery-powered soldering iron, with the tip grounded to the LNA board. Refer to the "typical" LNA schematic, Fig. 3. Be very *careful* to connect the gate leads, G1 and G2, before connecting the drain leads, D1 and D2. With a voltmeter across the 33-Ohm resistor, + probe to TPC, − probe to TP1, adjust G1 bias for a .33-volt reading. This indicates that 10 milliamperes of current is being pulled by the

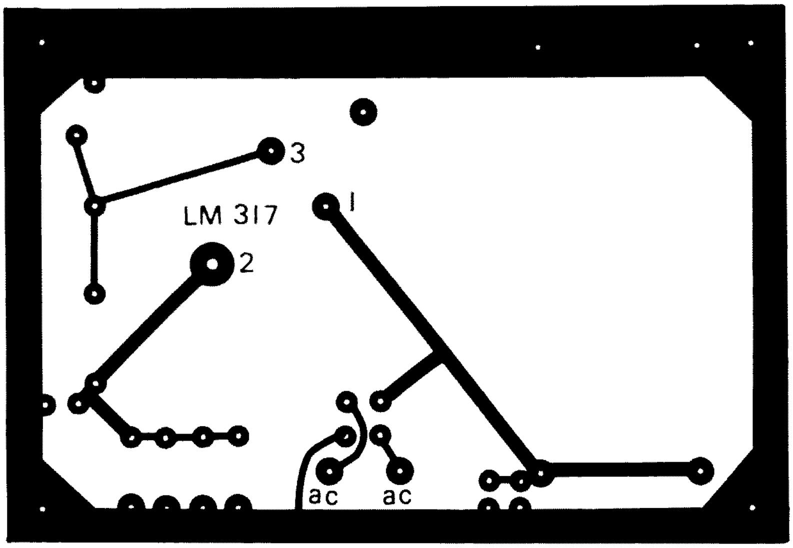


Fig. 6(a). Receiver power-supply PC board layout.

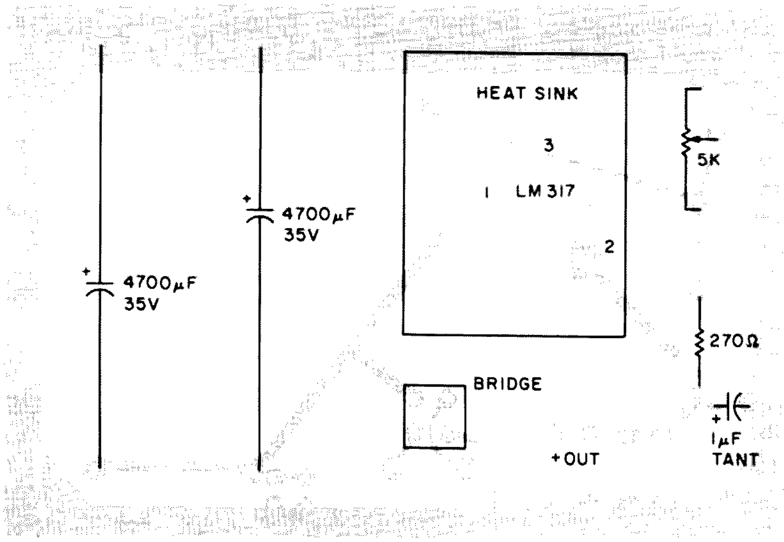


Fig. 6(b). Parts placement.

GaAsFET. Move the − probe to RP2 and adjust the G2 bias pot for a .33-volt reading. Now go back and check FET #1. As you adjust the bias pots, the current should *evenly increase*! If the current jumps or is erratic, the LNA is probably oscillating. How to stop oscillation is the subject of another article!

Using the above-described LNA power supply and tune-up procedure, the CEL LNA design came up beautifully, with no oscillation. Its two stages gave a solid, measured 21 DB of gain. We were unable to measure the noise figure directly, but the fellow with the test equipment said that it appeared to be very low, based on his evaluation of the ratio of gain to noise generated by the test equipment.

What type of picture do you get with a two-stage, 21-dB gain LNA that has an unknown noise figure? Very poor! After getting the first CEL LNA working, Richard was able to remove the NE21889s successfully from the commercial board. We built up a second board, using the cell design and our LNA power-supply board. Again, the CEL design came up with absolutely no problems. Now, by cascading the two boards, we were getting some results.

After optimizing the boards, which I will cover next, we have numerous transponders on SATCOM I above noise. We are located in the 32-33-dB footprint and the antenna is a home-brew 12-foot spherical. We have made comparisons of our four-stage CEL LNA and a 120-degree commercial LNA. Our home-brew LNA compares *very favorably* with the commercial unit.

Trimming an LNA for Best Noise Figure and Best Gain

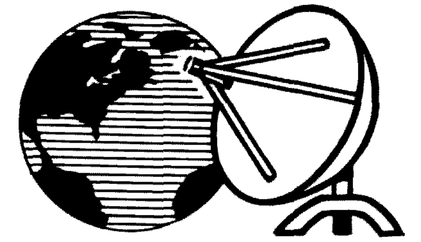
After having gone through the misery of trying to build an LNA with almost no information and absolutely no test equipment, we now can describe some of the procedures we had to discover the hard way.

The first step is to prepare a work area so that you minimize the possibility of blowing those costly GaAsFETs. A piece of printed circuit board makes an ideal work surface. Again, you will need a good isolated-tip soldering pen. Ground the tip of the pen to the work surface with a jumper. The battery-powered pen sold by Radio Shack works great. You should ground yourself to the work surface with a piece of copper braid. You also will need an X-acto® knife, a BB or small ball bearing, a plastic tuning wand, and a steady hand. Glue the BB or small ball bearing to the end of the plastic tuning wand.

The LNA, as built, should produce watchable video in most areas of the country. With power on and a transponder tuned in, make sure that the correct current is set for each stage of the LNA (10 mA per stage for the NE21889). You should monitor the current of each stage as it is trimmed. Place the BB on the PC-board trace edge as per Fig. 4. Slowly move the BB around the outside perimeter of the striplines, keeping it in contact with the stripline. Monitor the quality of the received picture as you move the BB. When a point is found where the picture quality gets better, you need to add copper to the stripline. If the picture quality gets worse, you need to remove some of the stripline by making *very* light cuts. We only score the copper with the X-acto knife so that it can be soldered back together if needed. Make several trips around the striplines and note the effect before doing any adding or trimming. Make a log of the points where changes occur and see if they repeat each time you run the BB by them. After you are convinced of the points that need changing, then make the necessary adjustments. Copper can be added by salvaging a piece of foil from another piece of PC board or by using GC Electronics Silver Print paint.

After the adjustments are made, make a slight increase in the current for each FET stage while watching the picture quality. We have run the current up to 40 milliamperes on a stage with no oscillation. The first stage will probably have to operate at 8 to 12 milliamperes for best noise figure. Successive stages can operate at higher current levels for more gain.

The basic power-supply design (Fig. 5) and PC board layout (Fig 6) power the bias board and also our complete satellite TV receiver. There is nothing special about it except, again, that an effort was made to use parts available from Radio Shack. ■



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You may request the CEL LNA Application Note AN80903 by writing to California Eastern Labs at 3005 Democracy Way, Santa Clara CA 95050. A copy of the Note is supplied with each LNA board ordered from Martcomm, Inc.

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Microwave Master

—you might not need a mountaintop

With the growing interest in satellite television reception, weather picture reception, and higher frequency utilization, the need for a better understanding of microwave principles becomes more important than before.

To better understand microwave techniques, we must first understand the frequency bands and the characteristics of the microwave spectrum in relationship to other lower frequency radio waves. As we know, radio waves travel mostly along the ground path and are not readily affected by mild changes in the weather or atmosphere. When we get into the microwave region, the characteristics are entirely different.

To begin, let us take a look at what microwaves are. Radio waves above the 1000-MHz level are called microwaves. It is a common practice to relate to this portion of the frequency spectrum in terms of Gigahertz (GHz), with a frequency of 1000 MHz being equal to one Gigahertz. The basic spectrum of microwave frequencies is made up of three very basic bands. These bands are: the S-band centered at about 3000 MHz (10 cm), the X-band at about 10,000 MHz (3cm), and the K-band at about 27,000 MHz (1.1 cm).

Table 1 shows the relationship between the bands by wavelength in both centimeters and inches, and Table 2 shows some of the services operating there. You will notice from the table that a full wavelength at the microwave frequencies is not very long. When we get into working with the construction of microwave equipment and subassemblies, these measurements will have a very significant meaning.

The first cavity magnetron was developed in Great Britain in 1940, after the publication in 1936 of two papers on hollow waveguides. These papers are: "Hyper-frequency Waveguides—General Considerations and Experimental Results" by G. C. Southworth, and "Transmission of Electromagnetic Waves in Hollow Tubes of Metal" by W. L. Barrow. During the period of early development around 1940, most of the experimental work was carried on in the Radiation Laboratory at the Massachusetts Institute of Technology. During this time, almost all experimental work in microwaves was directed towards the design and use of microwave radar equipment, due to the small size of antenna equipment required in the microwave region.

After the second world war, more efforts were made in other areas to the extent that today, almost all long-range telephone communications are relayed by microwave links. As scientific advances began in outer space, the role of microwaves became even more important. In fact, microwave technology has made possible many of the products used today in our homes, business, and in private industry. An example of a modern use of microwave technology is the microwave oven found in many homes and businesses.

Microwaves are also used in many of the security alarm systems found in business use and have been used by private industry for some time for cleaning of parts, removal of broken screws and bolts, and for controlling signal devices at railroad crossings and drawbridges. Another use with which almost everyone is familiar is the radar speed control devices used by police forces all over the country.

To understand microwave principles, we must first take a look at some of the characteristics of microwaves in relation to other forms of radiation. We must also learn what variables affect the microwave signal itself.

To begin, microwaves normally travel in one or all of four basic paths. These four paths are direct wave, reflected wave, surface wave, and sky wave. In most microwave installations, the direct wave is the desired path, although the reflected wave also may be of importance in some instances.

The direct wave is so named because of its direct path from one point to another. With optimum conditions, the most reliable communications can be ob-

Band	Frequency (MHz)	Wavelength cm	Wavelength inches
S-band	3,000	10	4
X-band	10,000	3	1.2
K-band	27,000	1.1	.44

Table 1. Microwave bands.

Service	Frequency	Wavelength cm	Wavelength inches
Amateur	1296 MHz	23	9.1
WEFAX	1691 MHz	17.8	7
MDS TV	1900-2500 MHz	15.8-12	8.2-4.7
Satellite TV	3700-4200 MHz	8-7	3.2-2.8

Table 2. Some services operating in the microwave frequencies.

tained through the use of the direct wave.

The sky wave normally is considered to be a wave that has been reflected from the ionosphere, a region that extends from an altitude of approximately 30 miles on out to about 250 miles. In the area of satellite television or weather fax, a signal which is transmitted from a satellite is not considered to be sky wave but, instead, falls under the classification of a direct wave that has been retransmitted.

Surface waves are waves that travel along the surface of ground or water. They are mostly predominant at the lower frequencies. At microwave frequencies this mode of propagation is usually insignificant and in most cases may be disregarded.

The reflected wave is a wave that has been reflected from the land or water surface of the area between the transmitter and receiver antenna sites. A factor that determines the strength of the reflected wave is the type of surface that the wave is reflected from. Land is considered to be a poor reflector and will scatter the wave in many directions. Water is a good reflective surface and generally will reflect the entire wave in one direction. The reflected wave is only important when the reflected signal is picked up at the receiving antenna with a strength comparable to the strength of the direct-wave signal. At this particular occurrence, the reflected wave may either boost the direct-wave signal or cancel it almost completely. The determining factor at this time is whether the two signals are in phase with each other. If the two signals are in phase, or nearly in phase, or if the two signals are of nearly equal strength, the combined signal can be twice as strong.

However, if the two signals are nearly 180° out of phase with each other, there will be a reduction in signal strength since the reflected signal will cancel some of the strength of the direct-wave signal.

A phase difference between the direct wave and the reflected wave is usually introduced by the difference in the distance each wave travels. This difference may vary from installation to installation and can be anything from a fraction of a wavelength to many wavelengths. When the path difference is an odd number of wavelengths, the two signals (direct and reflected) will arrive at the receiving antenna in-phase. This is especially true when the wave is reflected at small angles of incidence, which cause a phase reversal of 180°. In the case of horizontal polarization, the phase reversal is nearly 180° regardless of the magnitude of the grazing angle. This is also true for almost all instances of vertical polarization in most point-to-point communications systems.

An interesting fact about microwave energy is that the signal tends to be slightly curved. This is because the signals travel through the atmosphere at speeds that depend on temperature, atmospheric pressure, and the amount of water vapor present in the atmosphere.

The following three conditions will have an effect on the microwave signal: The *higher* the temperature, the *faster* the signal; the *lower* the atmospheric pressure, the *faster* the signal; and the *lower* the water vapor content, the *faster* the signal.

With these influences, the net result is that the signal speed changes with altitude. Under normal conditions, the variation is a small and uniform increase in speed of the signal with an increase in altitude. In this manner, it readily can be seen that in a way, the microwave signal acts very much like a light beam. Just as a light beam can be reflected or bent, so can a microwave signal be reflected or bent.

Using the above information, we also can see that microwaves can be very reliable for communications systems. The most important factor is to ensure as direct a line-of-sight path from the transmitter antenna to the receive antenna as possible. With prior study of the potential path, it is really not too difficult to plan a microwave system. The thing to keep in mind is that the complete path of the microwave signal must be free of any obstructions such as trees, hills, or tall buildings. When transmitting over water, the reflected wave may play an important role in the received signal. When you are designing over-water point-to-point systems, it is very important to ensure that this reflected signal does not arrive at the receive antenna in an out-of-phase or nearly out-of-phase state.

A simple rule-of-thumb method can be used to determine possible antenna heights, especially for over water paths. The antenna heights chosen must satisfy the following relation: $\sqrt{2H_1}+\sqrt{2H_2}=S$, where H_1 and H_2 represent the antenna heights in feet above sea level and S represents the distance in miles between the antennas.

The next step is to calculate a correction height using the formula $H=\sqrt{S/F}$, where H is in feet, S is the distance between the antennas in miles, and F is the operating frequency in MHz. The required antenna height for each antenna is the sum of the tentative height and the correction height for each antenna, or, more simply stated, $H_1 + H$ and $H_2 + H$. If the values obtained are not convenient, then select new tentative antenna heights and perform a new calculation.

For example, if we assume a transmitting antenna height of 1400 feet and a receiving antenna height of 2000 feet at a distance of 100 miles, the computation would be: $\sqrt{2(1400)} + \sqrt{2(2000)} = 100$ (miles). The square root of the H_1 component is 52.92; the H_2 square root component is 63.25. This gives us a total of 116.17 miles. It is then quite evident that one or both of the contemplated antennas are too high. By using the S value of 100 and working backwards with the formula, using H_1 as the base antenna and recomputing for H_2 height: $100 - 52.92 = 47.08$ squared $= 2216.53$ divided by $2 = 1108.26$ feet. Therefore, the

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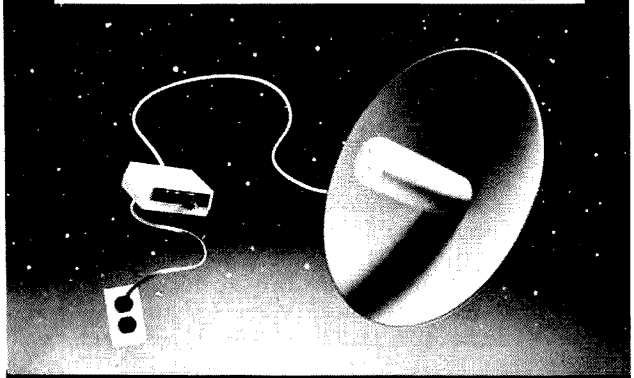

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new height that meets the relation is 1108 feet for H_2. By the same token, we could have kept antenna H_2 at the height desired and recomputed the height for H_1.

Using the corrected figures for antenna heights of 1400 feet for H_1 and 1108 feet for H_2, we now can compute the correction heights for both antennas at a frequency of 1296 MHz: $H = 660\sqrt{100/1296} =$ 183.33333 feet. This gives us a final figure of antenna height for H_1 of 1400 + 183.33 or a total of 1583.33 feet and for H_2 1108 + 183.33 or a total of 1291.33 feet. Given the figures above, we can now look for possible sites to install antennas.

Of course, we may not always find the ideal spots for our antenna construction. In this case, we go back and recalculate using different antenna heights (plus elevation above sea level) to obtain a relative figure equal to the desired distance figure. Sometimes just one or two feet may make the difference at the receive end.

In any attempt at microwave, if at first you do not succeed, try again at another location or change the height of one or both of the antennas. In selecting a good antenna site, a very good aid to locate the ideal sites is a topographical map of the area locality of choice. A source of information for obtaining topographical maps is at your state capital. Try writing a letter either to the State Department of Natural Resources or the State Forestry Division. There is a fee required for copies of these maps, but it is usually very small when one considers the information that can be obtained and the time that can be saved. Happy hamming on the microwave bands.■

HAM HELP

I am in need of the schematic and alignment information for a Gonset G-77 transmitter and information on a TU-8-B plug-in unit used with BC191/375 transmitters. I will copy and return your originals.

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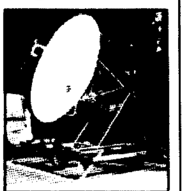

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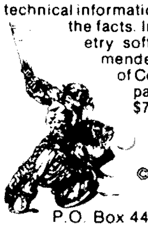

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CW Interface

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It is one thing to obtain software to decode Morse code with your computer, but it is quite another to process the audio signal delivered by your receiver in such a way that the computer can use it. This article will describe one approach to solving this hardware problem and also describe the construction and operation of an interface circuit using these principles.

I will assume that you already have software for decoding Morse and will describe the needed hardware. An example of such a program was presented by Thomas[1] in the December, 1977, issue of *73*. For our purpose, we will assume that your software requires a TTL signal that is logic low during the key-down intervals and logic high during the key-up intervals.

Proper operation of your decoding algorithm will require the presence of one logic level during the key-down interval and the opposite logic level for the key-up state. The computer must see only one or the other of these states at any one time, and they must change only when the state of the desired signal changes. State changes should not be affected by interfering signals or random noise.

An extremely simple circuit could successfully be used to interface a computer to a ham receiver if the audio signal produced by the receiver were perfect (absolutely noise-free and of constant level and frequency), but the circuit must be considerably more elaborate if the computer is to perform properly with the imperfect signals typical of ham-band operation.

Typical receiver output during CW reception on today's ham bands presents a difficult problem when attempting to decode the signal with a computer. Even if the operator is using a selective receiver (400-Hz bandwidth) designed for CW reception, several different signals usually will be present in the audio. The signal that the operator is trying to copy probably will be tuned for his preferred pitch, while the others will be present at other frequencies. The desired signals probably will be the strongest, but the others may be fairly strong also.

In addition to these interfering Morse signals, there will be noise. In the signal output that is available to the computer interface circuit, we will have, in general, voltage due to our one desired signal and also considerable voltage due to all the other signals and noise being processed by the receiver. In order to decode the desired signal successfully, we must have a way to detect the voltage due to our desired signal while ignoring as best we can the other signals and noise.

Desirable Interface Qualities

We can summarize several design objectives for our receiver-computer interface. First of all, it should be (as always) small, inexpensive, and easy to construct and operate. Second, it should respond only to one very narrow band of audio frequencies, for maximum immunity to adjacent signal interference and noise. Third, the output should be bistable and TTL-compatible for proper interpretation at the computer input port; the output should be either logic high (+3.5 to +5 volts) or low (0 to +0.6 volts) and never in between. Fourth, the decision threshold of the detector should be adjustable to allow the interface to operate properly with both high- and low-level audio so that the operator is not forced to operate a certain audio gain setting which may not always be convenient. And fifth, the interface should work while the speaker of the receiver is operating, so that the operator can hear the code while it is being decoded to allow detection of computer errors (decoding errors can be expected under adverse reception conditions).

Theory

Fig. 1 is a block diagram of one approach to doing the required processing of the receiver audio. The first stage is a limiter which produces a known signal level at the beginning of the circuit; this allows the rest of the device to be designed optimally for this level. The limiter is followed by a 4-pole active bandpass

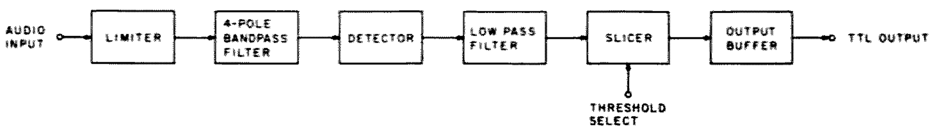


Fig. 1. Interface block diagram.

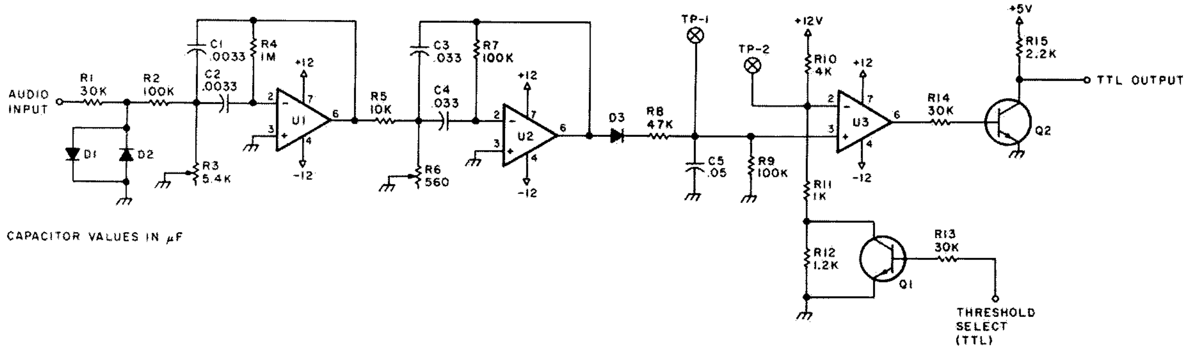


Fig. 2. Interface schematic.

filter. The filter is tuned to 950 Hz and has a design bandwidth of 80 Hz. This filter works by amplifying the signal about 16 times at its center frequency and attenuating signals not within its passband. This ensures that the detector stage only sees voltage due to the desired signal. The detector itself is merely a half-wave rectifier (a diode), and it is followed by a simple RC low-pass filter so that the output of the filter follows the pulse shape of the signal as closely as possible. The output of this stage will be maximum when the signal is present and minimum when there is no signal present.

The slicer stage decides whether there is a signal present or not. It does this by comparing a preset threshold voltage to the voltage it receives from the detector and filter. Whenever the received signal exceeds the preset threshold, the slicer quickly switches its output state from -10 V to +10 V.

Under ideal conditions, the output voltage at this point in the circuit would never exceed this preset threshold when only noise and interfering signals were present. If the voltage exceeds the threshold only when the desired signal is indeed present, no errors will be generated. If this is not the case (and usually it is not), errors will be generated whenever the combined level of the interference and noise exceeds the threshold. (The slicer will change state.) As soon as the voltage subsides, the slicer will revert to the correct state. For optimum operation of the overall hardware/software system, your decoding algorithm should be designed to ignore these spurious but unavoidable brief state changes due to noise.

Finally, the output buffer converts the signal levels produced by the slicer (which are incompatible with the computer input gates) to correct TTL levels.

The Circuit

Fig. 2 shows the schematic of one circuit that meets the design objectives outlined above. I know that not many people build anything exactly as it is described in a magazine article (neither do I), so I will not only describe this circuit but will also give a little of the thought behind the design choices that I made.

Diodes D1 and D2 form the limiter, and these should be silicon types to give a limited signal of about ±0.6-V peak at this point. R1 is used to keep the input impedance of this interface high so that it may be used across an existing high-impedance output of your receiver (the anti-VOX output on a Drake R-4, for instance), in parallel with whatever you normally connect to that output. So, this circuit can simply be added to your existing layout with little effect. Also, because the signal level is limited to 0.6 V, only about a 1-volt peak of audio signal is required at the input to this device. On my receiver, the anti-VOX output puts out more than enough voltage at moderate speaker volume levels. Another advantage of permanently connecting the interface to a high-impedance point in your receiver is that the speaker and headphone outputs can be used or disabled without affecting the connection to the interface.

Components R2 through U2 make up the 4-pole active bandpass filter. My first prototype used only a single-stage filter (2-pole), but I found that it was allowing too much interference from adjacent signals. I therefore decided to go to a 4-pole design, with the resultant much steeper skirts to the passband. The filter design itself was arrived at with the help of articles by Stark[2] and Stewart[3] in past issues of *73*, regarding active filter design. Each stage of the filter is designed for a Q of 10. The center frequency of stage 1 is 975 Hz and that of stage 2 is 930 Hz. This yields a 3-dB passband of about 80 Hz and very steep skirts and requires only 2 ICs. (Strictly following the criteria used by Stark would have yielded filter stages with higher Qs, but also would have required a total of 4 ICs and several more resistors in the design. My approach sacrifices some skirt steepness but eliminates many components. That was my choice.)

Each filter stage is designed for a gain of 4.8 so that at the overall filter center frequency of 950 Hz the complete filter has a gain of about 16. With the 0.6-V peak input, about 10-volts peak output is developed at the detector. If you would like to try your own hand at designing the filters (perhaps you'd like to use capacitors you have in your junk box or a different center frequency), use the procedures given in either of the above two articles but be careful to keep the first resistor (R2) around 100k or greater so that the input is not loaded down. R1 and R2 form a voltage divider, and smaller values of R2 will require more drive voltage from your receiver for full limiting.

Diode D3 is the detector, and R8, C5, and R9 form the simple low-pass filter. The filter components were arrived at by experiment, the goal being use of a physically small capacitor at C5 and optimum following of the keyed signal pulse shape at speeds up to about 30 wpm. These values meet these criteria well.

U3 is the slicer, and the resistor network R10, R11, and R12 with Q1 produce a software-controllable variable threshold. Using the indicated resistor values, when Q1 is not conducting, the threshold at pin 2 of U3 will be about 1.8 volts.

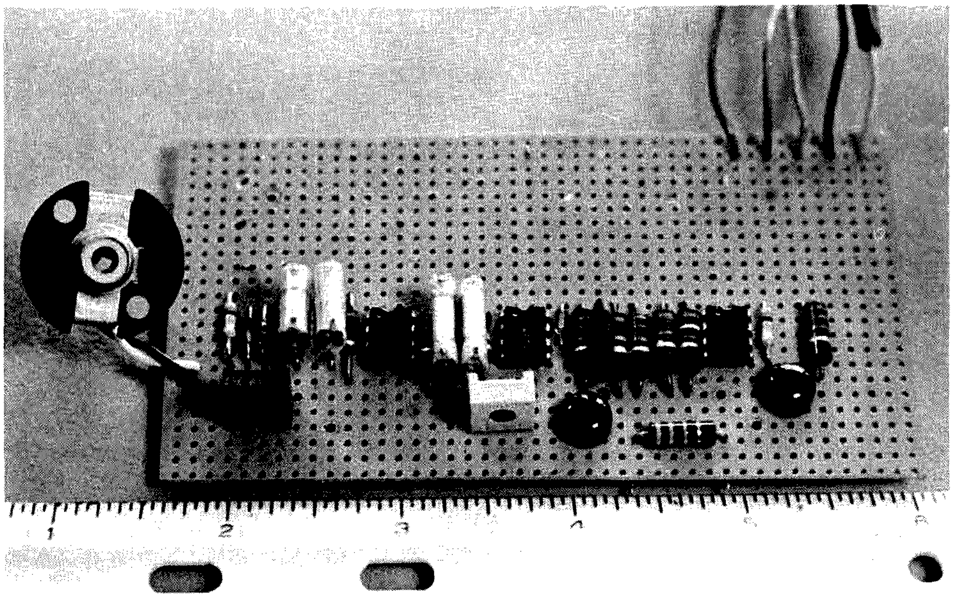


Photo A. Interface prototype.

When Q1 *is* conducting, the threshold will be lowered to about 1.0 volt. Thus, by tying the input to R13 to one bit of an output port, you can control the slicer threshold through software. This could have been done with a mechanical switch, but I wanted to mount this circuit deep within the bowels of my computer, controlled only by my commands via the keyboard. This approach took a while to design, but it requires very little additional space on the circuit board.

Under normal conditions, one would use the higher threshold for the best performance. But when you are operating with a signal level that is not strong enough for full limiting and noise conditions are favorable, you can extend your operating range by lowering the threshold to about 1 volt.

The output of U3 is either about +10 or −10 volts depending upon the detector output to U3. These levels could not be applied safely to the TTL input port of a computer, so the buffer stage, Q2, was added to provide a signal that always remains within the TTL operating range of 0-5 V. The output of Q2 can be tied directly to one bit of an input port.

With this circuit, the idle, or no signal, state of the output is logic high (+5 V). When a signal is present, the output drops to 0 V.

Construction

Photo A shows the prototype of this circuit in final form. My next step will be to reassemble it on a plug-in vectorboard for mounting directly inside my computer. As you can see, it requires a total area of about 2 by 4½ inches on the board. None of the components dissipates an appreciable heat, so it is safe to mount them adjacent to each other (but be careful not to short any leads). The wires visible in the upper-right portion of the board are for my temporary power and computer connections to the circuit.

All resistors used in the circuit need be no larger than ¼ Watt. I used what I had in my junk box, so some of the resistors in the photo are ½ Watt. Capacitors C1 through C4 should be high-quality polystyrene or mylar™ (and not disc ceramic) as pointed out by Stark. Try to get values for R2, R4, R7 as close to those listed as possible—although the final adjustments of R3 and R6 will compensate for any variations from the optimum values. The values for the two trimpots, R3 and R6, need be considered only approximate, and the final adjustment of these two can be expected at about mid-range if the indicated values are used.

Diodes D1 and D2 must be silicon types (small signal) and D3 can be either silicon or germanium. C5 can be disc ceramic. Q1 and Q2 are any *general* purpose silicon transistors capable of operating with a 2-mA collector current and a beta of at least 100 (type 2N3566 were used here).

As you can see from the photo, it is not necessary to etch a PC board. All three ICs are type 741. Power supply voltages of +12, −12, and +5 volts are required, but these should be available readily in most computers.

Alignment and Check-Out

The only alignment required is that of properly tuning each filter stage. For this, you will need some type of known frequency audio input. Apply an input to the circuit at 975 Hz, at a level of 1 volt or greater, and adjust R3 for maximum output at pin 6 of U1. Change the input frequency to 930 Hz and adjust R6 for maximum as measured at pin 6 of U2. You then should find that the 2-stage filter has a center frequency of about 950 Hz and an 80-Hz passband. With an input signal level sufficient for full limiting, about 10 volts (peak) signal should be available at the output of U2. Under these same conditions, the voltage at TP-1 should be about 3 volts (dc). As a final check, you can confirm that the output of Q2 is +5 V with no signal applied and 0 V when a 950-Hz signal is present.

Operation

Once the above initial alignment is completed, no further adjustments need be made. When operating the interface, all one must do is tune the desired CW signal properly so that it falls within the filter passband and adjust the receiver's audio level to an optimum value. These two tasks, however, are not quite as easy as they sound.

The easiest way to tune your receiver for optimum operation of the interface requires *an* oscilloscope. While there is another technique, it has some severe limitations. I will first cover tuning with an oscilloscope, and then the alternative if a scope is not available.

Oscilloscope Method

For the moment, let us assume that you have a dual-trace oscilloscope at your disposal for operation of your receiver-computer combination. Connect one channel to TP-1 in the circuit and the other channel to TP-2. Use dc coupling for both. Use a vertical sensitivity of 500 mV per division for both channels and a sweep speed of 10 ms per

division. Adjust the baselines of both traces to exactly the same point near the bottom of the graticule. You should then obtain a display similar to that shown in Photo B when a properly tuned signal is being received.

In the example, both traces have their zero baselines one division from the bottom of the graticule and the vertical and horizontal settings are as recommended above. The trace visible about one division above the center of the graticule is the TP-2 threshold voltage (about 1.8 V). The other trace shows the leading edge of a CW pulse that is being received. This display shows just about ideal reception conditions and is what you should strive for in your tuning. At the baseline of the signal trace, we can see that there is almost no noticeable noise between CW pulses. This situation is rare but does happen occasionally. (Indeed, the photo was taken during reception of a very strong off-the-air signal at about 25 wpm.)

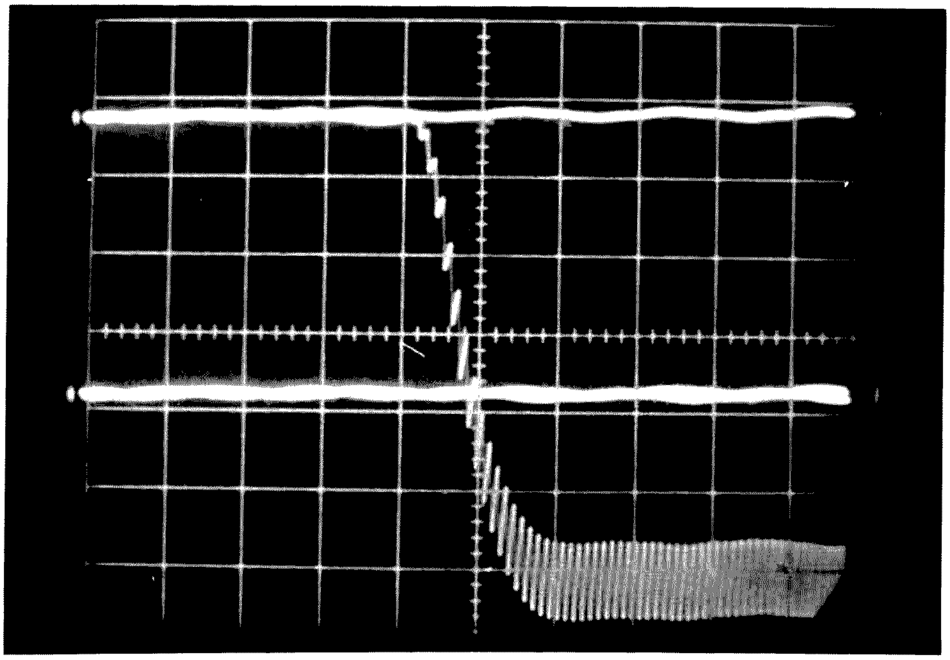


Photo B. Oscilloscope display.

The first step in tuning is to tune the receiver until the tone of the desired CW signal is centered in the filter passband, as evidenced by a maximum signal amplitude for the signal pulse on the oscilloscope display. This will take some care, due to the narrowness of the filter passband. After this condition has been achieved, the next step is to optimize the level of the receiver audio which is being fed to the interface. Making this choice optimally will require a little experience on your part (which will come with time), but I can give you a few hints.

Your primary goal is to maximize the signal-to-noise ratio at the slicer (which is what the TP-1 signal shows). This condition will give you the minimum error rate out of the slicer stage, and hence within the decoding algorithm in the computer. Since you have a limiter in the first stage of the interface, you will notice that you can increase the level of the desired signal only up to a point, beyond which it will no longer increase.

You will notice also, however, that if you continue to increase the drive level, the amplitude of the noise and interference evident between pulses *will* increase. This is undesirable. Therefore, you want a condition where the signal gives the greatest difference between the peak of the signal and the peaks of the noise and interference as viewed on the scope. Next, decide whether the normal (high) threshold voltage is best or if the lower threshold would be better. Ideally, the threshold of the slicer should be halfway between the signal peak and the noise peaks. Then, by monitoring the oscilloscope display, you can ensure that the signal remains optimally tuned even if your receiver drifts a small amount or if the noise and interference conditions change.

When using this type of display, it is convenient to have the current slicer threshold (TP-2) superimposed on the display with one channel of the scope, but it is not absolutely necessary. If you have only one single-channel scope, just remember where you have set your threshold, or use an external voltmeter to monitor it while you display the TP-1 signal.

Alternate Tuning Method

As you probably have guessed by now, without an oscilloscope it would be very difficult to adjust the receiver for the optimum conditions described above. This does not mean that you cannot tune it to work fairly well most of the time, however. A VTVM attached to TP-1 also will give an indication of when you have reached maximum signal strength, but its fluctuations with the signal will be much more difficult to interpret. You also will have very little ability to judge the noise conditions between the pulses, but, if you are having a problem, you can compensate for these by doing a little trial and error with the detection threshold and seeing which one works better. You will find that you must tune the receiver slowly in order to find the very narrow passband of the filter.

Summary

This circuit evolved over several months of experimentation and testing, and I think it is a good compromise between circuit complexity and satisfactory performance. I think you will find, however, that while the computer can do a very good job of decoding well-sent Morse code under good reception conditions, the machine is no match for the human brain when it comes to poorly-sent code or very adverse noise or interference conditions. ■

References

1. Thomas, William L., "Decode Morse—With an 8080," *73*, December, 1977.
2. Stark, Peter A., "Design An Active RTTY Filter," *73*, September, 1977.
3. Stewart, Dr. John F., "At Last! A Use For Your Computer," *73*, April, 1978.

REVIEW

KDK FM-2025A TWO-METER FM TRANSCEIVER

When you think about two-meter transceivers, what brand names come to mind first? Chances are, you'll name one of the big "full line" imported labels. There is nothing wrong with this except that you may be overlooking some of the other guys. What about firms like Azden and KDK? Both concentrate on selling a specific but high-quality line of radios. Until recently, I dismissed firms like these as "also-rans." Then I had a chance to review KDK's new FM-2025A two-meter FM transceiver. Now I'm a firm believer.

The FM-2025A is the latest in a series of two-meter mobile rigs that are manufactured by Kyokuto Denshi Company and imported into the United States under the KDK name. The 2025 represents a rather substantial departure from the earlier models, which included the 2015R, a great rig once you modified it. The staff at KDK has learned its lesson well; the FM-2025A offers many of the features that today's ham expects yet it remains simple and straightforward to operate.

Diode Matrix Programming

Like many of its modern day counterparts, the 2025A utilizes microprocessor control. In what seems like a step into the past, KDK has chosen to use a binary-coded-decimal diode (BCD) array to act as a program for the computer. Shades of the venerable Icom IC-22S. Or is it? Twenty-five diodes are used to program such functions as the low-frequency band edge, high-frequency band edge, transmit high-frequency band edge, a choice of 5-kHz or 12.5-kHz steps, the standard repeater offset, and band-scan step size. The unit comes factory programmed in a manner that will appeal to the vast majority of North American users. However, if you move overseas or have a need to operate outside of the US amateur allocation, it's a straightforward task to reprogram the KDK to meet your new needs.

If you are like me, most of your two-meter operating is done on a few local repeaters with occasional forays to other machines if you're traveling. Perhaps the easiest way to use the KDK is to program your favorite machines into the memories. There are two sets of memory, five channels each. You can use the channels independently or in a duplex mode where you receive on the "A" channel and transmit on the "B" selection. Since I frequent only a few repeaters, I find myself using the duplex mode. That way, I don't have to worry about switching the repeater offset selection when I change frequencies.

If you use more than five channels on a regular basis, then you may want to make full use of the ten memories by employing the offset switch for everything but the repeaters with oddball splits. The FM-2025A includes a nicad battery that provides internal backup for the memory when the radio is switched off. The infinitesimal 57-nano-ampere current drain allows the battery to last for as long as one year between charges.

Scanning

The FM-2025A offers two modes of scanning. You can search the ten memories for an open frequency or for a frequency in use. When the channel changes status, the receiver starts scanning again. If you want to lock the rig on frequency, just flip the scan control to the HOLD position.

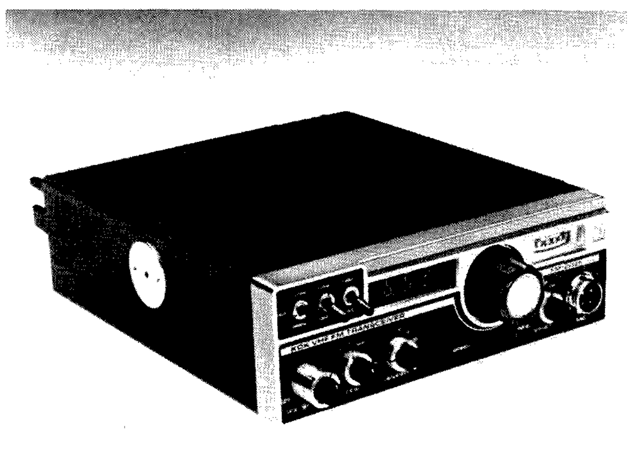
The same options are available in the band-scan mode. The scanning starts with the frequency stored in memory A5 and proceeds upward to a limit determined by the contents of B5. But you can't fool the rig; if the B5 frequency is lower than the A5 selection, there will be no scanning.

The nice thing about the KDK's band scanning is its zero detector. This ensures that receiver scanning stops only on the center of a signal. The only difficulty I encountered came when I tried to scan near 144.000 MHz. An internal spur caused a false locking there.

One useful 2025A extra is a built-in tone switch. An internal switch allows you to select between a continuous tone or a half-second tone burst. There is no need to run out and buy a new encoder if your favorite machine goes private. There is easy access to adjustments for the tone generator's frequency and output level.

Procedures like this are explained well in the instruction manual. Unlike many manuals that accompany new gear, the KDK book is written with the assumption that the reader has some intelligence; it presents more than just an idiot's guide to installation. You'll even find four pages of technical and adjustment information plus a larger-than-usual schematic diagram.

The KDK's construction is nothing short of rugged. The vast majority of the rig's circuitry is on two boards, with the digital-based control circuitry on one and the rf blocks on the other. The lack of interconnecting wiring harnesses and cabling leads me to believe that the 2025A will easily withstand a harsh mobile environment.



The KDK VHF FM-2025A transceiver.

The back panel includes a jack for an external speaker (and once you have tried this you will never settle for a built-in speaker again), antenna and power connectors plus an accessory connector that includes microphone input, audio output, transmit-receive switching, and connection to the 13-volt dc power supply.

Moving back inside, I noticed that all of the frequency generation and most of the audio circuitry was centered around integrated components. The rf section still utilizes a fair number of discrete semiconductors, but the chip-based technology is rapidly closing the gap.

Plus and Minus Points

With a growing trend towards higher power for two-meter transceivers, the 2025A holds it own with a choice of two power levels, either one of which can be set between 3 and 25 Watts. If you need still more power, then consider an amplifier; you also get the added advantage of a receiver preamplifier that way. Unlike most of the other new FM rigs appearing on the market, KDK retains the traditional d'Arsonval meter movement for the power-out and signal-strength measuring chores. I can't knock the newfangled LED bar displays without trying them, but I do know that the old-fashioned meter makes the radio look more "professional."

Among the bells and whistles that you won't find on the 2025A is a priority channel. Nor is there a provision for up/down scanning via switches on the microphone. For me, the lack of these features had no effect on my operating style.

Perhaps the biggest drawback of this easy-to-use radio is the close proximity of the volume/squelch, mode, and memory-select knobs. They are all the same size and easily confused if you don't glance down at the rig.

On an overall basis, I give the FM-2025A high marks. It represents a substantial step forward in ease of operation.

While it doesn't resemble the mission-control-panel look prevalent on a lot of new rigs, it is a sophisticated, feature-laden radio. It should be especially popular with amateurs who want a radio they can tinker with. The 2025A certainly proves that KDK is more than just the "other guys" when it comes to building radios.

In late 1981, the FM-2025A was priced at $299. For more information, contact *KDK Distributing Co., 617 South Gallatin Road, Madison TN 37115*. Reader service number 476.

Tim Daniel N8RK
***73 Magazine* Staff**

DFD SYSTEMS RT-89 RTTY SYSTEM

The DFD Systems RT-89 package is a disk-based RTTY system for Heath/Zenith H89 and H8/H19 computer systems. It runs under the Heath Disk Operating System (HDOS), providing unmatched features and flexibility for the serious RTTY enthusiast. The system is designed to operate on a single-drive, 48K machine with plenty of space left over for disk read/write files and memory buffer space. All input/output operations are buffered and interrupt driven, allowing true full duplex (send-while-receive) operation and real-time disk file read/write capabilities without loss of data.

There are 66 commands implemented to configure the system and control program operation. In addition, a special file, "RTTYINIT.TTY", is automatically read at program start-up time to establish the initial system environment. This file can be individually tailored by the user to automatically boot the system in any desired configuration.

RT-89 will operate at speeds of 60, 66, 75, and 100 wpm in the Baudot mode, or at any standard ASCII baud rate from 110 to 19,200. Automatic synchronous idle (diddle) may be selected at any of these speeds in either mode, and an automatic down-shift-on-space (DSOS) feature is selectable in the Baudot mode. All CW identification is automatic, including an ID at nine-minute intervals during any single transmission. This feature can be disabled with a keyboard command if desired. In addition, a CWID shift control and transmitter on/off control are available from the computer.

An automatic disk log is maintained each time the transmitter is keyed, and manual entries may also be inserted on the log at any time with the N= command. The time of day is automatically recorded with each log entry, so the system log can also be used as the station log if desired!

System line width can be varied from 20 to 80 characters since the H89/H19 terminal has a full 80x25 line display. The screen is split into four functional areas: a receive window, a transmit and command window, a split-screen and status-display bar, and a "times square" moving-marquee format on the 25th line that displays the transmitted data as it is actually transmitted. This latter feature is useful when the transmit buffer has been preloaded or a disk file is being transmitted, since the transmit window displayed the buffer contents as the transmit buffer was loaded, and the 25th line actually displays the buffer data as it is being sent. Therefore, the operator always "sees" what is being transmitted over the air at any given time. The sizes of the receive and transmit/command windows are dynamically variable and may be changed at any time during system operation. In fact, any commands may be issued at any time (except during transmit), so there is never a need to stop the program to reset any parameters as there is on some other systems.

The system may be directed to ignore carriage returns in the receive window, thus "packing" a maximum amount of data on the screen. The carriage returns are not ignored, however, on the printer or disk files, so the actual format of the received data is not lost (you can write on the printer, read and write on disk, and receive and transmit all at once, in real time, due to the interrupt-driven I/O structure).

Any number of files can be written to or read from disk at any time, and the printer may be turned on and off at will, independently for received and transmitted data!

A variable-length "word-correction buffer" is provided to allow correcting of keyed input data prior to its release to the system. The length of this buffer may be set from 1 to 80 characters, and facilitates backspacing over entry errors and correcting them before transmission. There are actually two cursors displayed on the screen: a flashing underline cursor which indicates where the word correction buffer starts, and a destructive block cursor indicating the next location that will be occupied by keyed input. In addition, the system can be directed to automatically "wrap around" when the end of a line is reached and no carriage return is keyed. In this event, the system will automatically move the last word keyed to the next line, if it is incomplete, and issue the carriage return itself.

An unusual and very enjoyable feature provides the ability to process RTTY pictures. The system may be placed in the PIX mode, and overlining will be allowed on input and output files and the printer. In addition, three off-line programs are included with the package that will allow one to edit PIX files with the standard HDOS text editor, and automatically compress and expand those PIX files to conserve disk space. PIX files received over the air are actually compressed before they are written to disk, and compressed PIX files on disk that are read for transmission are automatically expanded by the system at transmit time!

In addition to the unlimited disk file capability, there are three temporary single-line buffers that can be loaded and read out using the three colored function keys on the H89/H19 keyboard. These are handy for holding calls of current stations in QSO or repetitive contest information. Other function keys can be used to insert the current date and/or time in the transmit buffer. (The time of day is also always maintained on the split-screen bar.)

In operation, the TX or TXF commands will put the system in transmit mode, and a CONTROL-C will terminate the transmit mode. Data can be entered into the transmit buffer while in receive mode, and that data will be transmitted the next time TX (transmit) mode is entered. TXF (transmit fast), on the other hand, will not send the data in the transmit buffer, but will only send data keyed from the keyboard. TXF, therefore, is used to answer a quick question or to send a quick message without sending the data in the transmit buffer. After TXF, more data can be entered into the transmit buffer, if desired.

Disk-based commands include opening and closing disk files for either read or write, displaying directories, deleting files, exchanging files, and swapping disks in drives 1 and 2.

Performance

The RT-89 system has performed very well for more than a year of operation on both the HF and VHF bands. The system was designed to support Navy MARS message traffic as well as amateur traffic, and has now replaced all mechanical teletype equipment at Navy MARS stations NNN0AFL and NNN0ZVW. No system problems or failures have yet been encountered at either station.

The system includes complete operational documentation and directions for interfacing the computer to a terminal unit. The system has been successfully interfaced with a HAL ST-6, commercial and home-brew Flesher TU-170s, and the iRL-500. The iRL-500 interface was the easiest to accomplish since it already had inputs and outputs to directly interface to the computer at RS-232 voltage levels.

Each RT-89 system is personally generated for each purchaser to include the station callsign. This callsign is permanently displayed on the split-screen bar during system operation and is used in generating the CW identification. Minimum hardware requirements are an H8 (with an H19 terminal) or H89 computer, a single disk drive, and 48K memory. HDOS is also required to operate the system. The package consists of the programs on a 5¼" diskette and an instruction manual. The cost is $39.95. For further information, contact *DFD Systems, 4805 N. 107th Street, Omaha NE 68134*. Reader Service number 477.

Dick Jugel K0DG
8014 Taylor Circle
Omaha NE

INTERFERENCE HANDBOOK

Whether the alphabet-soup nomenclature is TVI, RFI, or EMI, interference is a constant threat to the radio amateur, lurking in the shadows, waiting to

turn docile neighbors into a horde of angry enemies. Even though the war against interference has just begun, there is hope for the ham-radio army. Radio Publications' new book, *Interference Handbook*, is destined to become a bible for the tactics-minded foot soldier. The author of *Interference Handbook* knows what he is talking about; William Nelson WA6FQG is the veteran of sixteen years of trench warfare as an RFI investigator for Southern California Edison Company.

RFI has plagued us ever since Marconi made his first transmissions nearly a century ago. While modern-day legislators and manufacturers grapple over a long-term solution, the problem gets worse and the poor radio amateur is caught in the middle. The approach that *Interference Handbook* takes is best summarized by the quote: "The purpose of this handbook is to outline the many sources of interference; explain how to eliminate or reduce them; and tell you how to protect yourself against RFI. The causes and cures of RFI are discussed in nontechnical language that is easy to read and understand."

The topics discussed range from interference caused by home appliances and the RFI emitted by power lines to the misunderstood role that hams and CBers play in causing and solving interference problems. Along the way, the author gives case histories based on his years as an investigator.

Tips for locating interference with inexpensive gear are accompanied by descriptions of commercial and homemade cures. The contents will be of interest to anyone who deals with electronics. This could include the members of a radio club interference committee or a music lover who is plagued with automobile ignition noise. The book is rounded out with a listing of addresses for gaining help from manufacturers.

Interference can work both ways as evidenced by recent experiences at the *73 Magazine* ham shack. Several months ago, a pulsating noise of unknown origin kept us bewildered (and off the air) for several weeks. More recently, a neighbor has complained about TVI that may be the result of our station. In both of these cases, a volume like the 247-page *Interference Handbook* would have helped to reduce the mystery and aggravation for everyone involved.

A paperback edition of *Interference Handbook* is available from the publisher, *Radio Publications, Box 149, Wilton CT 06897*, or *73's Radio Bookshop, Peterborough NH 03458.*

Tim Daniel N8RK
***73 Magazine* Staff**

LETTERS

QRZ CONTEST?

The weekend is here, I can't wait to get my cup of coffee, go downstairs and turn on the rig, and relax with some CW. Cranked up the old workhorse, my TR4-C, switched on the keyer. I love CW, my phase of enjoying ham radio, and spend most of the time on 20 meters and a little on 40 meters.

Here comes the audio, and what? Not again! The entire band loaded! Another contest? I thought they just finished one; you know how time flies. I must admit I have been in only one contest, in the early 60s, and cannot remember what it was for, but learned it was not for me. There are no redeeming factors in them that I can see. A field day or emergency preparedness operation so as to be able to get a station on the air fast in almost any location, portable, of course, to assist those in need of help, I am all for without exception, but to sit for 12 or 24 hours at a key or a microphone causing a traffic jam worse than the California freeways ever saw is a gross waste of time and energy.

I enjoy a good rag chew—or at least to find out more than a QTH and a name that's in the *Callbook*—talking over your experiences, experiments, good or bad, is a greater way to enjoy one's on-air time.

Let's think about it; contest weekend as it appears to me seems to relate itself to the opening of hunting season, the night before everyone participating making final preparations, checking their "guns" for the big day. From cannons to peashooters they are all ready. The clock is ticking away the last few minutes before the action begins. The beams are poised at each other, power supplies humming away, fingers begin twitching, one ready to send, one ready to record the contacts, then bang! A solid wall of rf rips through the ether and for the next day the battle for the climb to the top rages on. Stepping on each other, over, under, and around. When the period of time for the contest is over and the electromagnetic radiations clear, the battlefiled can be seen strewn with broken and mangled coffee cups, smoking ballpoint pens, splinters of pencils, and scraps of paper. The casualties are entering the "hospitals" with keyer finger, tennis wrist, another form of keyer finger, and ear-ring: a new one, being a depression in a circular fashion around both ears, manifested by a constant series of tone bursts that won't subside.

Why so many contests? Aren't there enough awards to be gotten on one's own without the additional promotion of contest after contest? I would like someone to reply and let me know.

Now don't get me wrong. I have gotten a few of those symptoms myself. What I am trying to say is those who prefer contests are good hams, they enjoy their phase of ham radio, a great hobby filled with very nice people. But all I ask for us in the apparent minority is that on those special weekends, those who sanction such contests *think*, think of the other hams who are not participating and leave at least 10 or 15 kHz aside for those of us who would like to just get on and relax with a good QSO, be it CW or SSB.

Why should the bands be totally monopolized during these periods? A lot of us just do not have the time to spend on the bands and really look forward to our weekend operation.

Gary L. Jackson N2ACX
Delron NJ

N2ACX UR 599 NH DE WB8BTH BK.

THANK YOU, ERIC

As a subscriber, I feel it is my duty to inform you of the good job you are doing. I am a new subscriber to your magazine and I love it! I am 13 years old and a General class ham. My father is also a ham and he likes your magazine, too. Between my father and I we receive *QST, Ham Radio, CQ, 73,* and *CVRA-SERA Journal*. We enjoy your magazine the best. The $25 is well worth it. I find many interesting articles in your magazine. In *QST, Ham Radio,* and *CQ* I rarely find a really good article. Many times the advertisements are the best things in *QST*! I can't say *QST* is a bad magazine—it has many important references. The other magazine (journal), *CVRA-SERA Journal*, is a great magazine. I find it and *73* the most interesting.

Thank you for your time. I just wanted to tell you how great your magazine is. Keep up the good work!

Eric Lassiter KA4KEG
Danville VA

WIN SOME, LOSE SOME

The last of the ham radio publishers bit the dust! I never thought you would pass us off for the quack electronics, but my new December issue with satellite TV, computer scanners, and all really opened the old eyes. I think I'll go back to model trains. I get enough of the electronic garbage at work all day. NO renewal for me next spring.

Ed Chenoweth K4HYG
Zephyrhills FL

Sorry to lose you, Ed, but we do have to bring news of what is happening in electronics to those amateurs who are helping the hobby to grow. . . who are interested in things beyond spark gaps. I realize that not all hams are going to be inventing and pioneering new techniques, but

I had hoped that those who are more interested in taking a free ride on the shoulders of those who are doing the work would at least be honorable enough to read about it and cheer them on instead of trying to shoot them down.—Wayne.

KNIT PICKING

Seldom do I write to the editor of a magazine, but every once in a while something will catch my eye. Such was the case when you asked in the October *73 Magazine* what we could do to spur the growth of ham radio.

Let me state that I am flatly opposed to no-code licenses. We already have them in the form of citizens band communications (I use the word "communications" with some reservation in this case), and I for one don't want 15-meter phone sounding like that. I really can't imagine that you do either.

Now to the basic question: What can we do?

1. We can exert pressure on the Federal Communications Commission through our elected representatives to take the tricks out of amateur exams. For example, a friend recently took (and passed) the Extra class examination in Boston. Part of his code proficiency test involved the apparent word "Springfield," but on the tape it was sent "Cpringfield." Granted, this quickie will determine if the examinee is paying absolute attention, but does it prove anything else? Is this the type of thing one would encounter in a normal QSO (which the tape is supposed to emulate)? I think not.

2. We can stop regarding ourselves as an elitist group. While my previous reference to citizens band could be construed as elitist—and perhaps it is—we must recognize that our hobby is no better than that of anyone else. If a CBer wants to be a CBer, then so be it. If an audiophile gets enjoyment from his "thing" then let him. We should not continue with the attitude that everyone in electronics either should "progress" into the ham fraternity or be relegated to second class. Perhaps if we are less pushy more people would *want* to join us.

3. Along the same lines, we should make more of an effort to help the newcomer. We spend a lot of time and effort getting people into ham radio through Novice classes, but how many Novices have given up on our hobby because the Techs, Generals, Advanceds, and Extras were too busy with their own interests to give a hand *after* the newcomer got that much-anticipated ticket? If you're not really sure of what you're doing and there's no one to help, amateur radio can be pretty confusing. Take the time to help a Novice; you may be saving tomorrow's Extra class licensee.

4. Again, along the elitist line, we need to have more of those "in the know" willing to make what they know readily available. It does not seem consistent to this writer that an editor of a widely-read ham publication could advocate the spread of our hobby on the one hand and then ask $1,000 or more for a speaking engagement at a hamfest on the other. Granted, Dayton and Birmingham can probably afford this tariff, but Windsor (our local hamfest) can't, and Windsor is more likely to touch a greater number of new and prospective hams in central Maine than are Dayton and Birmingham combined. Please don't take this as a personal attack, Wayne, but you *did* ask for constructive ideas.

5. We need more affordable equipment designed for beginning amateurs. Unfortunately, our hobby is pricing itself out of the reach of many would-be joiners because they can't afford a Kenwood TS-530, an Icom 720A, or an Astro 150. What we need are more Ten-Tec Century 21s that let the little guy get his feet wet with new (a Novice doesn't need the problems which often come with used gear), reasonably priced, and effective equipment.

6. Finally—for now, at least—we need effective representation in the FCC. Some government commissions are required to reflect in their membership the interests of those that they regulate. Why not a ham as a required commissioner, and a CBer, too? Who knows better what we want than one of our own? Certainly not some politician from the "in" party who had the misfortune of losing in the last election.

Well, Wayne, there you have it. I hope this letter will prompt others to put on their thinking caps and come up with more and different ideas. I wouldn't even object if theirs were better.

Bill Crowley K1NIT
Hallowell ME

No offense, Bill; the $1,000 goes for a special fund for promoting amateur radio, not into the general coffers. Without that limitation I've found that I am getting dozens of invitations to talk... few of which would be possible for me. Thus, this is a filter... and also a benefit for amateur radio. You're right about the tricky exams... there is no excuse for them. There will be cheaper ham gear for beginners when we have enough beginners to make it profitable to make the stuff. Remember that plenty of equipment has been put on the market in the past, but it has not been continued due to an almost total lack of newcomers. And look what happened to the newcomer magazine, Ham Horizons!*—Wayne.*

THE HEATH SNOOZE

I have just finished the conversion of my Heathkit clock as stated in the November issue of *73 Magazine* ("Extra Accuracy for Heathkit Clocks," page 124).

There were no conversion or cross-reference lists at any of the local Radio Shack stores for a switch with part number 275-430. I could have used another RS switch, but keeping with amateur radio practice I quickly realized that the Alarm Set Switch (SW3) could be used and the old Snooze Alarm Switch (SW2) wired in its place. It is a little cumbersome to use in setting the alarm, but then I don't use this function. My clock works as stated in the article.

The wiring is done in the same manner as Art N5AEN stated, and the new SW3 is wired as shown in the clock manual.

Others may be interested in this miser's scheme to beat down the rising cost of ham radio.

I've enjoyed *73 Magazine* and will continue to do so.

Jack Garner KB7HH
Phoenix AZ

THE BIG ZAP

When I read *QST*, I first look at the silent keys. With your *73*, I read the editorial. I was especially interested in the radar devices you use and test. My mobile friends tell me the devices are not very good anymore. The policeman with the gun pops it on and gets a reading and you are hooked. No more carrier to seek out. I don't travel much anymore, but I do have a new approach to traffic tickets.

I propose a tape-deck player and a specially-prepared deck that starts with fifteen seconds of soft music, and then a convincing commercial announcer who breaks in with the news that the USA is being attacked by USSR missiles and the President is on his way by helicopter to the Virginia underground shelter...all citizens are to go to any nearby shelter. News flashes give reports of missiles twenty minutes from Chicago, Detroit, Washington...

I think by this time the trooper is on his way and you are free to go to your destination.

Just don't get stopped by the same guy the second time.

Ed Kirchhuber K4JK
Elkmont AL

Fiendish... I like it! The radar gun? I've only run into one once in New Hampshire so far, so it isn't much of a problem here. In that case, I got plenty of warning before I even got close due to the sensitivity of the superhet detector and was safely not transmitting on two meters when I went through the check point. Your detector should pick it up a half-mile to a mile away and give you plenty of warning to stop transmitting so you won't rack up a speeding ticket even when you are moseying along at 55 per. The officer generally takes a shot at a car ahead of you and you pick up that blast. This also gives you a chance to check your speed... which averages around 70 mph on most of our interstates.—Wayne.

GUS TRAVELS AGAIN

Those of you who have been around ham radio for more than a few years undoubtedly remember Gus Browning's fabulous DXpeditions of the 50s and early 60s. Well, W4BPD is back at it again and will be sending us monthly reports on the progress of his current round-the-world trip. Welcome aboard 73, Gus!

This little episode is being written while we are at anchor down in Florida awaiting a few minor repairs to be completed on the boat, but by the time you read it we will be somewhere in the Caribbean. We have named the ship *DX* since DX is what it's all about with us. Our mail address from now until this trip is completed is just "DX, 29039, USA."

A friend of mine talked with me up at DXPO 80 last September and asked me the question, "Have you ever thought about another DXpedition, Gus?"

You know what my answer was ("I have the time if you have the money"), and he said that money was no problem! It ended up that a boat was purchased and the old rat race of getting it shipshape for a real DXpedition began. The result is that here we are about to take off for the *complete* Caribbean tour; we'll go to every country down there that we can get permission to operate from. (They tell me that licensing is no problem at almost every one of them.)

This feller Wayne Green must have lots of pull somewhere because both on our way from Annapolis to Beaufort, South Carolina, and then again from Beaufort down here, I saw a sign on the Inland Waterway on the left side each time with the numbers 73 on a *green* background. And this Wayne Green don't fool around, neither, because when I mentioned writing a series of letters for *73 Magazine*, he said, "Don't stand there, start writing." So here I am doing just that.

This DXpedition should be considerably different from the others I have been on. This is planned to be an island-hopping DXpedition with inland excursions when it's possible and worthwhile from a DX viewpoint. We will be going by the seat of our pants all the way. This DXpedition by boat sure will be a lot better than the other ways I have used before, and it sure will be lots cheaper to charter a ship than to spend anywhere from $100 on up per day the way I've done it many times before. Since 99% of our traveling will be sailing, using the wind for power, it will be very interesting to see how our overall expenses compare with those of trips when other means of transportation were used.

The purpose of the first portion of this trip will be twofold: We will be shaking down the boat and we will be trying to see how we get along with each other being cooped up over long periods of time in a small space. There are three of us—myself, my XYL, Peggy, and Sam, a WA3 from the Washington DC area who purchased the boat. So far we are quite compatible, though at times a little touchy with each other, which we all expected before we ever got started.

Our tentative plans are to cover the Caribbean, probably taking until the next hurricane season, which starts next June. Then we will sail back to Beaufort to have the boat gone over with a fine-tooth comb and to visit all the grandchildren, the kids, and our friends. We'll restock the boat's larder, tighten up all the bolts and nuts, and then take off for the Panama Canal, the big, wide Pacific, and all those countries out there waiting for us to Dxpedite. If things are still "go," then we will continue on around the world, hitting as many spots as we can along our line of travel. We won't mind deviating from this line of travel a few hundred miles when, from a DX viewpoint, it looks like that's what we should do.

The very first thing we all agreed upon was that we wanted this trip to be a safe one. Since we have no set date to be anywhere along our route, we can always wait for the weather to get right before we depart from spot A to go to spot B. If all three of us like a certain place and want to spend a few more days or even weeks there, we will do just that. This will more or less be a leisure trip with DXpeditioning a first priority on our list. Right now, we are at the creeping stage; we hope to be at the walking stage when I write the next installment, and at the running stage from there on out.

We have a very good ship, an O'Day 37 (measuring 37 feet long and 11 feet across). How would you like to make something like this your complete home for up to five years? It will be on the rough side, but we will be in there trying our best to stick it out. Our ship is fully equipped with all the very latest gear. We have a satellite navigator that does a better job of pinpointing our position than most maps. We have a good radio direction finder, a good VHF transceiver, and, of course, a sextant, which I have practiced on for months. I still need more practice to get good on it. We have a huge pile of maps and charts but will need many more when we get to the Pacific and other oceans on our way around the world.

We will be taking it easy along the way and hamming as much as possible. We plan to use both CW and SSB on equal terms, going by the apparent needs of the fellows. We have the full Ten-Tec line of gear, their Omni-C, Hercules linear, electronic keyer, and antenna tuner for the long wires we may put up for the low bands. I cannot get over the Ten-Tec's fast break-in, the no tuning when you change bands, and the almost silent receiver when you disconnect the antenna. As a back-up, we have Ten-Tec's Delta. Our antenna is a TET and it will get a real test of endurance on this trip. As you can see, we're delighted with the equipment we have.

QSLs will go out three different ways. When we have time after the trip, every QSO in the logs will go out via bureaus. The second way of QSLing will be direct to those who send their cards to out "DX 29039 USA" headquarters and contribute $1.00 to help us defray the cost of QSLs, postage, and Girl Friday making them out. The third method will be direct from the spot where we work you or, if necessary, from the next spot we operate, to those making a $2.00 contribution to help us with expenses. (We do not expect to come anywhere near breaking even on our expenses.)

I don't think we can help anyone with 300 or more countries, but we might be able to help you if you have 200 or so. Maybe we will help some of you on 40, 80, or 160 meters. Later on we may use other means and ways of communications. We are, of course, open to your suggestions. We may or may not follow them, but "try us"—hi.

On CW, look for us 25 kHz from the low end, except on 160, 80, and maybe even 40. On SSB, when we are not under FCC rules, we will try using more or less these frequencies: 28490, 21190, 14105, 7090, 3790 kHz; and on 160—who knows, hi. But once we settle down on the frequencies we want to use, these will be where we will always be found, plus or minus QRM. I can promise you I will never get mad at anyone on the entire trip. A real nuisance to us may have a difficult job getting our QSL for his contact—the last laugh will be us doing the laughing, hi.

Up to now, there has been very little contributing or donating by anyone, so I am under obligation to just a few and I know who they are. I don't mind tail-enders or any other way you can come up with to get your call in my log. I try to work the weak ones first, so if you are QRO please go QRP if you want to work us first, hi. At times we will QSY into the Novice bands and will usually be tuning in the parts of the band Generals can use. But you had better have wide shift-split capabilities, or you may miss us. Occasionally, we will use transceive, but don't depend on this mode for many contacts with us. I say get yourself an outboard vfo and join in with the real DXers.

There will not be any of this list type of stuff on this DXpedition—if you want to QSO, get in there and work me. I don't want any of this stuff: "Gus, so and so said you are Q5-S7"; I want to hear that report and call myself without any assistance from helpers on the sidelines.

That's it for this episode, fellows—73 de Gus BPD.

Gus Browning W4BPD

HAM HELP

I am in need of technical information for the RCA AR88D receiver. I am also looking for a 24-hour brass ship's clock.

Mickey McDaniel W6FGE
940 Temple St.
San Diego CA 92106

I am searching for information on the use of electric limit switches with a Triasto TX-455 crank-up tower.

Don Greenwood KC8GZ
2687 Timothy Place
Wooster OH 44691

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

HAMS AND COMPUTERS

Shh! Keep this quiet! Don't tell anyone, but I think microcomputers are taking over amateur radio.

Take last Friday, for instance. I'm working this station on CW—AF2M, I think the call was—and he's telling me about his rig, the weather, and all those other things that make QSOs so interesting. Then, all of a sudden, something must have blown in his shack because he just keeps sending "599, 599, 599. . ." After about 10 minutes of having my signal verified, it dawns on me—AF2M is a machine! Egad! This is worse than CB. At least on the chicken band you pick up animals, not androids.

It's scary. So scary, in fact, that I decided to write a column about ham radio and microcomputers. Here it is but don't tell anyone. I hate to be an alarmist. Where the heck did I put my nightlight?

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1 Letters and numerals
8 Below high frequency (abbr.)
9 Direct memory access (abbr.)
10 Computer lingo
13 Package type (abbr.)
15 Operating position
18 ____ line
19 Former big-time computer manufacturer (abbr.)
20 Program that revises (2 words)
22 And off
23 Data processing (abbr.)
25 Bulletin board (abbr.)
27 Semiconductor type (abbr.)
29 GOSUB

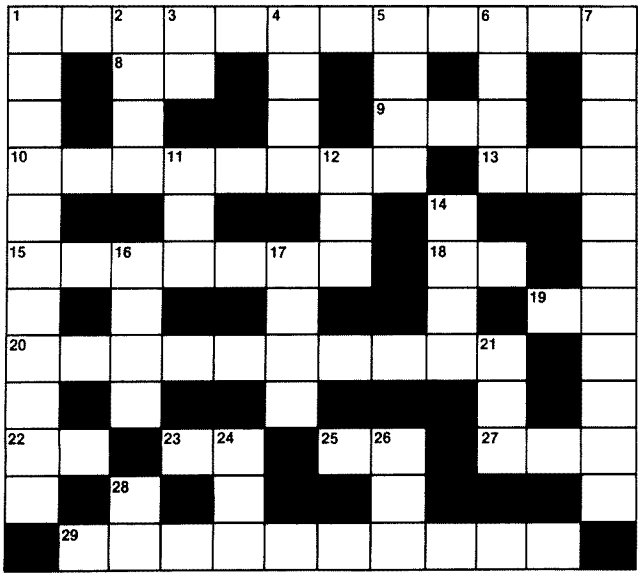


Illustration 1.

Down

1 Computer use
2 Scheme
3 Below VHF (abbr.)
4 They bought micro for shuttle (abbr.)
5 Statement of condition
6 "Only" type of memory
7 User
11 Crummy software often runs out of this
12 Golly
14 Instruction
16 To follow immediately
17 Bright diodes (abbr.)
21 Memory type (abbr.)
24 Cycles in a second
26 Smallest computer unit
28 μ

ELEMENT 2—MULTIPLE CHOICE

1) Computers can exchange information by using a code known as ASCII. What does this acronym stand for?
   1. American Standard Code for Interchanging Information
   2. American Standard Code for Information Interchange
   3. American Standard Code for Interconnecting Information
   4. American Standard Code II

2) Who was Herman Hollerith?
   1. Father of the punch card
   2. Father of punched paper tape
   3. Inventor of the floppy disk
   4. Inventor of the CRT

3) What are "Napier's Bones"?
   1. The remains of August Napier, inventor of the first analog computer
   2. The first pocket calculator, named for the device's ivory color
   3. A figment of the imagination
   4. Ivory rods which, when placed next to each other, can be used for multiplication calculations

4) An "automaton" is:
   1. A mechanism under the constant control of its own resident intelligence
   2. A mechanism under the constant control of a human or other external intelligence
   3. A mechanism under the constant control of a programming routine previously supplied by an external intelligence
   4. A waste of time

5) How many laws of robotics did Isaac Asimov detail in his book *I, Robot*?
   1. One 2. Two 3. Three 4. Four

ELEMENT 3—TRUE-FALSE

	True	False
1) HAL, the computer in *2001: A Space Odyssey*, was built at the Hal Plant in Urbana, Illinois, on January 12, 1997.	____	____
2) Speaking of HAL, his name stood for **H**euristically-programmed **AL**gorithmic computer.	____	____
3) The word "robot" was coined by Czechoslovakian author Karel Capek in his play *R.U.R.*	____	____
4) An early electronic computer, **EN**IAC (1946), contained 19,000 vacuum tubes.	____	____
5) After ENIAC, there was a computer called MANIAC.	____	____
6) PASCAL, the computer language, was named after Blaise Pascal, a 17th century French philosopher.	____	____
7) The "Computerist's Code" states that a computer user should never use his equipment to harm anyone.	____	____

8) BASIC is a high-level language. ______ ______
9) Bubble memory uses microscopic magnetic bubbles. ______ ______
10) CPU stands for "Control Programming Unit." ______ ______

ELEMENT 4—HIDDEN WORDS
(Illustration 2)

Hidden in this puzzle are words representing 15 different computer terms. The words are formed in any direction—horizontally, vertically, or diagonally, forwards or backwards. As you find each word, circle it.

G	W	Z	M	A	T	R	L	O	A	D	E	P	T	I
A	I	A	R	I	A	D	A	B	A	E	A	O	A	S
R	D	I	B	R	L	W	N	C	I	B	A	U	D	R
B	D	A	A	Y	A	X	I	H	N	U	C	E	L	E
A	I	Y	R	O	M	E	M	F	E	G	G	N	U	A
G	E	R	A	P	B	N	R	I	C	V	S	A	M	T
E	A	R	C	I	S	T	E	E	D	K	G	T	N	T
J	O	B	O	O	T	S	T	R	A	P	T	H	D	R
R	W	D	M	U	N	A	R	E	A	A	G	R	I	A
E	H	S	P	I	D	P	X	S	G	T	L	V	A	H
T	H	I	I	J	E	R	C	S	A	R	Y	E	S	C
N	N	O	L	T	N	A	D	D	R	E	S	S	K	W
I	E	S	E	J	L	A	D	D	P	T	N	E	E	O
R	D	G	R	O	E	F	S	G	S	Y	D	O	N	L
P	W	R	E	H	Y	R	A	N	I	B	A	R	R	F

Illustration 2.

READER'S CORNER

Do you have a ham-related puzzle you would like to share with FUN's readers? Then send it in for a chance to see your name in print. This month's contribution is by Joe Strolin K1REC, of Norwalk, Connecticut.

MAGIC SQUARE
(Illustration 3)

Circle any number, then cross out all numbers in the same row and column. Do this until only one number is left, to get the message.

Send in your answers. We'll print the name and call of everyone who solved the puzzle.

14	15	13	16
13	14	12	15
21	22	20	23
23	24	22	25

Illustration 3.

THE ANSWERS

Element 1:
See Illustration 1A.
Element 2:
1)—2. And you know what great stuff American Standard makes.
2)—1. Ever noticed how these cards are only a little larger than a dollar bill? That's because HH used the dollar bill of his time (1890) as the template for his card. He invented the card and its reader for use in the US census.
3)—4. Scottish inventor John Napier (1550-1617) developed this precursor to the slide rule.

A	L	P	H	A	N	U	M	E	R	I	C
P		L	F		A		O		E		O
P		A			S		D	M	A		M
L	A	N	G	U	A	G	E		D	I	P
I			A			E		G			U
C	O	N	S	O	L	E		O	N		T
A		E			E			T		G	E
T	E	X	T	E	D	I	T	O	R		R
I		T			S				A		I
O	N		D	P		B	B		M	O	S
N		M		E			I				T
	S	U	B	R	O	U	T	I	N	E	

Illustration 1A.

G	W	Z	M	A	T	R	L	O	A	D	E	P	T	I
A	I	A	R	I	A	D	A	B	A	E	A	O	A	S
R	D	I	B	R	L	W	N	C	I	B	A	U	D	R
B	D	A	A	Y	A	X	I	H	N	U	C	E	L	E
A	I	Y	R	O	M	E	M	F	E	G	G	N	U	A
G	E	R	A	P	B	N	R	I	C	V	S	A	M	T
E	A	R	C	I	S	T	E	E	D	K	G	T	N	T
J	O	B	O	O	T	S	T	R	A	P	T	H	D	R
R	W	D	M	U	N	A	R	E	A	A	G	R	I	A
E	H	S	P	I	D	P	X	S	G	T	L	V	A	H
T	H	I	I	J	E	R	C	S	A	R	Y	E	S	C
N	N	O	L	T	N	A	D	D	R	E	S	S	K	W
I	E	S	E	J	L	A	D	D	P	T	N	E	E	O
R	D	G	R	O	E	F	S	G	S	Y	D	O	N	L
P	W	R	E	H	Y	R	A	N	I	B	A	R	R	F

Illustration 2A.

4)—3. 1 is an android, 2 is a robot, and 4 is what noting the differences is.
5)—3. And if you break one of the three, you'll get a robot fine.

Element 3:

1)—True Long way from the ST-5000, Dr. Chandra.
2)—True Try saying that 10 times, fast.
3)—True Rossum's Universal Robots.
4)—False Ha-ha; slightly under 18,000.
5)—True Engineers just love snappy acronyms.
6)—True Blaise Pascal (1623-1662), who, after a day of philosophizing, would tinker with his adding machine.
7)—False The computerist's what?
8)—True Also the most popular, as if you didn't know.
9)—True And if you look through a microscope, you can even see them move.
10)—False Central Processing Unit.

Element 4:

See Illustration 2A.

SCORING

Element 1:
Twenty-five points for the completed puzzle, or ½ point for each question correctly answered.

Element 2:
Five points for each correct answer.

Element 3:
Two and 1/2 points for each correct answer.

Element 4:
Two points for each word found.

Are you digitally inclined?

1-20 points—Still mad at the government for outlawing spark.
21-40 points—Thinks computers might have a future.
41-60 points—Likes to play with display computers in stores.
61-80 points—Owns a nice, sensible computer system.
81-100+ points—Home-brews own computer.

AWARDS

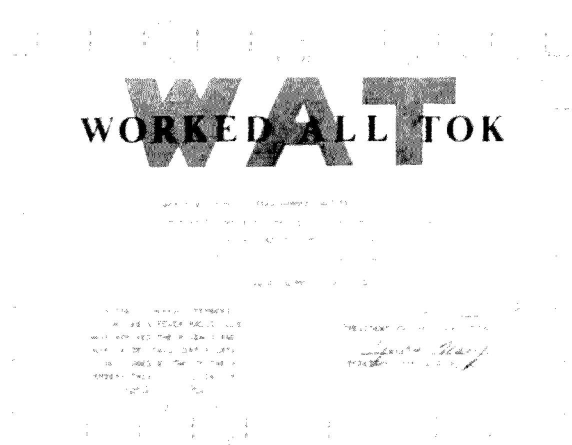
Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

WAT AWARD

The Cabin Fever Radio Club of Tok, Alaska, offers a certificate for contacting three amateurs in Tok. There are no band or mode restrictions. However, all contacts must be made after December 15, 1980, to be considered valid.

To apply, prepare a list of contacts in order by callsign. Include the name of the station operator, the date and time worked in GMT, and the mode and band of operation. QSLs not required. Amateurs located in Tok include AL7O, AL7BO, AL7BV, and WL7APG.

Send your application with $2.00 or 10 IRCs to: Cabin Fever Radio Club, Box 451, Tok AK 99780.

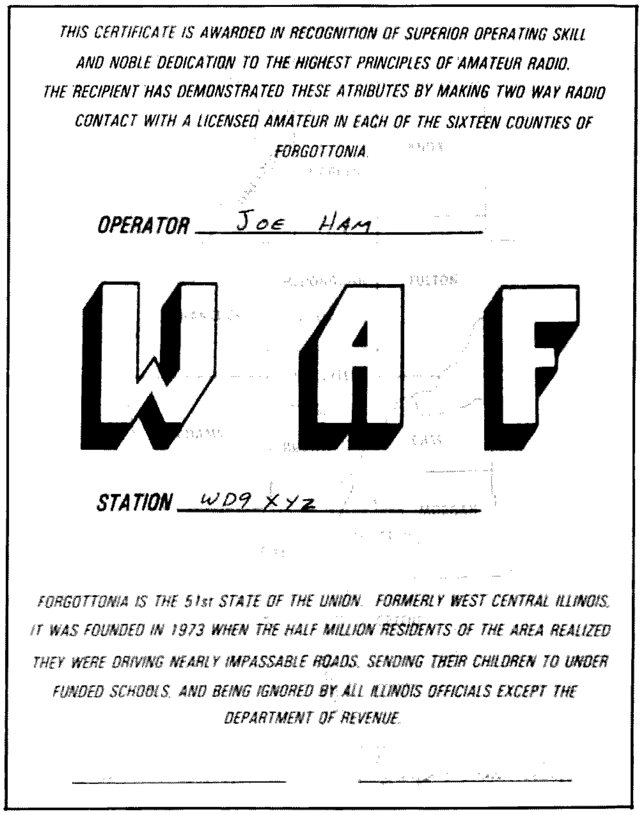


WORKED ALL FORGOTTONIA

Announcing the awards program sponsored by LEARC, the Lamoine Emergency Amateur Radio Club of Macomb, Illinois. The Worked Forgottonia award is issued amateurs who confirm contact with three (3) licensed amateurs of Forgottonia. The Worked *ALL* Forgottonia is awarded operators confirming contact with at least one amateur in each of the sixteen counties of Forgottonia.

What is Forgottonia? It is the 51st state! It consists of the following counties, formerly west central Illinois: Adams, Brown, Calhoun, Cass, Fulton, Greene, Hancock, Henderson, Knox, McDonough, Mercer, Morgan, Pike, Schuyler, Scott, and Warren counties.

All contacts must be made after June 28, 1980, to be valid. From the letter we received from the club, the award evidently is issued at no charge since no remittance was mentioned. Forward your list of verified contacts and a 9" x 12" SASE to the attention of AG9Y, c/o LEARC, 1224 Maple Avenue, Macomb IL 61455.



JUNIATA VALLEY

In March, the Juniata Valley Amateur Radio Club (JVARC) will be celebrating its 25th year as a bona fide club. In honor of the event, they will be operating a special event station. The club station is K3DNA, located in Lewistown PA (Mifflin county). Having started operation in January, their heavy operation is scheduled for the month of

March. The station will operate on different bands, CW and phone, according to the operators' wishes. One contact with any club member will entitle the operator to receive the club certificate.

VK1 ACHIEVEMENT AWARD

The A.C.T. Division of the Wireless Institute of Australia is proud to announce the creation of its newest award, the VK1 Achievement Award. This award has the aim of increasing interest in the VK1 prefix and in promoting Canberra and Australia internationally.

As there are only 300 VK1 licensees, the award will not be an easy one to achieve, particularly on some bands and modes.

The VK1 Award is available to licensed amateurs throughout the world. To qualify, stations within Australia must work 20 stations in VK1 land on HF and on VHF. Stations outside Australia must work a minimum of 10 VK1 stations for the HF segment of the award.

To apply, submit your list of contacts, including the GMT time and date worked, the band and mode of operation, and any reports or ciphers exchanged.

To be valid, all contacts must be made on or after January 1, 1978. Endorsements may be given at the time application is made. Five IRCs or $2.00 in Australian currency covers the cost of the award and should be sent to the Award Manager, c/o WIA, PO Box 46, Canberra A.C.T. 2600, Australia.

By the way, the VK1 Award is also made available to shortwave listening stations on a heard basis. QSL confirmation is required.

SNOWFLAKE MADNESS

The Michigan Technological University Amateur Radio Club and the Copper Country Radio Amateur Association announce a radio celebration of our Winter Carnival festivities in the northernmost part of Michigan's Upper Peninsula.

Tech's Winter Carnival is probably the most spectacular winter festival in America, with fantastic snow sculptures, dogsled races, lots of skiing, and other festive events.

In association with the Copper Country Chamber of Commerce, they are issuing a certificate to all amateurs who make contact with any ham in the Copper Country between 0000Z January 25 and 0000Z February 1. Only one contact is required for the certificate.

Suggested frequencies are: 3.975, 7.105, 7.285, and 21.385. Listen for CQ WINTER CARNIVAL.

Send your QSL along with 2 (two) 20-cent stamps to: Kevin J. Nietzke WD8DQR, 2005D Woodmar Drive, Houghton MI 49931.

WORKED BROWARD COUNTY CITIES

The Broward Amateur Radio Club, Inc., sponsors the new WBCC award available to licensed amateurs who submit proof of two-way contact as follows:

A) Residents of Broward, Colliers, Dade, Glades, Hendry, Lee, Martin, Monroe, or Palm Beach counties must work all 29 of the following cities listed below.

B) All other amateurs must work 15 of the 29 cities within Broward county.

To be valid, all contacts must be verified by at least two fellow amateurs and application must show all logbook information as well as the QTH of the station worked.

To apply, mail your application with $1.00 US funds and two first-class stamps (DX stations; send 10 IRCs) to: BARC Award Manager, WD4RAF, 1921 NW 41st Street, Oakland Park FL 33309.

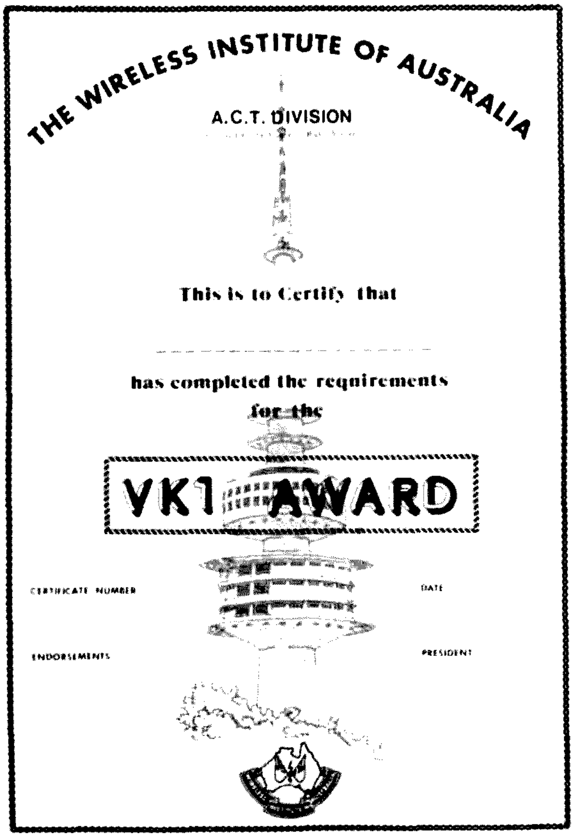
Qualifying city contacts include: Coconut Creek, Cooper City, Coral Springs, Dania, Davie, Deerfield Beach, Fort Lauderdale, Hacienda Village, Hallandale, Hillsboro Beach, Hollywood, Lauderdale-by-the-Sea, Lauderdale Lakes, Lauderhill, Lazy Lake, Lighthouse Point, Margate, Miramar, North Lauderdale, Oakland Park, Parkland, Pembroke Park, Pembroke Pines, Plantation, Pompano Beach, Sea Ranch Lakes, Sunrise, Tamarac, and Wilton Manors.

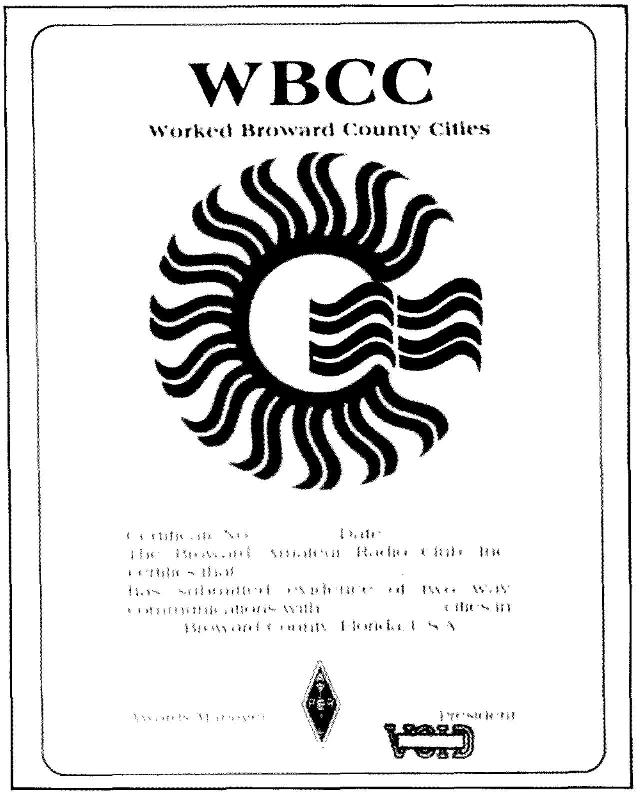
THE SOUTH EAST QUEENSLAND TELETYPE GROUP AWARD

This award is open to all transmitting and listening amateurs who gain award points in the following manner:

Australian amateurs must score 5 points and overseas amateurs must score 3 points.

(a) To qualify, a station must, where possible, copy the official station of the South East Queensland Teletype Group, VK4TTY, during a news broadcast and in the case of a transmitting amateur par-





ticipate in the callback (2 award points). A portion of the printout of the news broadcast together with the date, time, frequency, and broadcast number are to accompany the request for the award.

(b) Additionally, a transmitting amateur must work three member stations of the South East Queensland Teletype Group on RTTY (1 point each). Log extracts and/or printouts are to be included with the award application, and each member station may be counted only once towards the award.

(c) Listening amateurs should, in lieu of (b), forward log extracts and/or printouts of three contacts involving different member stations of the South East Queensland Teletype Group (1 point each).

Applicants for the award should forward the above information together with one dollar Australian or 5 IRCs to cover postage and printing costs to the Secretary, SEQTG, PO Box 274, Sunnybank, Queensland 4109, Australia.

WORKED ALL BERMUDA AWARD

The WAB Award is issued to amateurs throughout the world by the Radio Society of Bermuda. To qualify, applicants must submit proof of having worked a minimum of nine (9) parishes in Bermuda as listed below:

1. Sandys
2. Southampton
3. Warwick
4. Paget
5. Pembroke
6. Devonshire
7. Smith's
8. Hamilton
9. St. George's

The award is an antique map of Bermuda (20" x 23") suitably inscribed with the recipient's name and callsign and is signed by His Excellency, the Governor of Bermuda.

The award is not available to stations who worked Bermuda via mobile including maritime or aeronautical mobile. No band or mode endorsements are available. Only one mobile or portable from within Bermuda may be used in making claimed contacts on your application.

QSL cards are required as proof of contact and they must be sent to the awards manager with sufficient postage for their safe return. The Bermuda Award is issued free of charge! Submit your applications to: Award Manager, PO Box 275, Hamilton 5, Bermuda.

WORKED ALL DU AWARD

This award is available to all licensed amateurs who can show proof of having contacted at least one station from each of the call areas in the Republic of the Philippines (DU1 to DU9, except DU5).

Contacts may be made on any band or mode and special endorsements will be issued upon request for All-Phone, All-CW, Single-Band, or Five-Band accomplishments.

Contacts for the DU Award must be made on or after January 1, 1970. To apply, forward a list of contacts which have been verified by two officers of a radio organization. Your application must show all logbook information for each contact. Send the list and $4.00 US funds only (no IRCs please!) to: Edwin Zambrano DU1EFZ, PO Box AC-166, Quezon City 3001, Philippines.

All ASEAN Award
xx class

This award is given to 73 Magazine ***for establishing two way contacts with radio amateur stations in member countries of the ASEAN namely; Indonesia, Malaysia, Singapore, Thailand, and the Philippines.***

Awarded March 25, 1980 ***by the ORIENTAL DX CLUB, Quezon City, Philippines.***

Edwin Zambrano
President, ODXC

WORKED ALL ASEAN AWARD

The WAAA program requires the applicant to work other amateurs in the member countries of the Association of Southeast Asian Nations:

Work 5 Philippine contacts, 1 Malaysian contact, 2 Indonesian contacts, 1 in Thailand, and 1 station in Singapore.

Special endorsements will be given for All-Phone, All-CW, Single-Band, and Five-Band contacts.

Have your list of contacts verified by at least two radio club officials and be sure all contacts were made after January 1, 1970, to be valid. Forward appropriate logbook information in your application along with $4.00 US funds only (no IRCs) to the Award Manager: Edwin Zambrano DU1EFZ, PO Box AC-166, Quezon City 3001, Philippines.

KAHANER REPORT

Larry Kahaner WB2NEL
PO Box 39103
Washington DC 20016

By now you probably know that the FCC gave up in its attempt to rewrite the Amateur Radio Service rules. After spending thousands of dollars and consuming thousands of man-hours, the whole idea was thrown in the trash compactor.

We may never learn exactly what led to the shelving of the massive revamp nor will we ever realize any benefit from all that work. However, several FCC employees said privately what we all know intuitively about the project: It was just too big and too complicated to be completed.

You must admit the main premise was sound. Whenever a government agency wants to put its rules into plain English, we should all support it. In this case, it went a little too far. Opponents called the rewrite overly simplistic and said that many of the fine points of amateur radio were lost in the translation. They also claimed that the question and answer format—which worked so well for the rewritten CB rules—just didn't work for hams. Amateurs, they declared, were intelligent and took offense at the condescending stance of Q & A.

Moreover, the bulk of hams who responded to the petition

for rulemaking took umbrage at the very beginning of the rewrite proposal which dropped the famous reasons for amateurs' existence: promoting international goodwill, experimentation, and so on.

FCC officials told us that the rewrite contained many errors and mistakes—not just typos, but in substance as well. And although FCC proposals always contain errors, in this case it would have been just too much work to set things right. Normally, the commission works with opponents and proponents alike until the regulations are honed to where everyone can live with them. But for the ham rewrite, there was too much to do, too few staff to do it, and no funds available to keep the project alive.

On one hand, the FCC should be applauded for realizing that it would take resources beyond its means to complete the task and dropping it now before any more time and money was wasted. On the other hand, perhaps the commission should be scolded for even beginning a course of action that came under fire from hams at the onset. Even those in the commission expressed doubts as to whether it was necessary to rewrite the rules. It's certainly apparent that much of the impetus for change was political (see Kahaner Report, September, 1981). That should never be a reason for a government agency to do anything with taxpayers' money.

So, it seems that hams fought the measure and won. But the question arises—who lost?

OUR OWN CHANNEL 9

Paul Moratto KC5JK/6, from Universal City CA, mailed the FCC a petition for rulemaking requesting that it designate a particular 2m frequency to be used exclusively as an emergency and assistance channel. Paul also sent us the petition asking for our comment. Here goes.

It's a great idea, Paul, but it's not necessary. Hams don't need the FCC to set aside a special channel for emergency use. Hams can do it on their own.

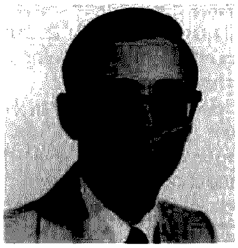
If hams can set up a national simplex channel (.52) and work out an entire repeater coordination scheme which only few hams don't adhere to, they can certainly decide for themselves if they want one frequency designated for emergency and assistance use only.

In his petition, Paul noted: "Various law enforcement officials have stated that the 2-meter amateur band is rarely monitored due to that fact that *no emergency frequency* has been officially designated exclusively for such communication." Frankly, Paul, I doubt that police departments would be willing to shell out bucks for a scanner that would pick up 2 meters or even buy crystals to place in scanners they may already own. Indeed, cops have enough to listen to without keeping an ear open on another frequency. If and when ham radio ranks reach that of CBers, maybe they'll listen—but right now it's not worth it.

Besides, even if they heard a distress call, they couldn't respond unless they were licensed hams. Many police are, but many aren't.

Any hams out there want to start work on a national emergency channel? Be my guest. Although I can't answer for the FCC, I'll bet they'll tell Paul exactly what I just told you: "If you want to do it, do it. You don't need us."

CONTESTS



Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

RSQB 7-MHZ CONTESTS

Phone Section
Starts: 1200 GMT February 6
Ends: 0900 GMT February 7
CW Section
Starts: 1200 GMT February 27
Ends: 0900 GMT February 28

Licensed radio amateurs and listeners throughout the world are invited to take part in this year's RSGB contests. Log and cover sheets may be obtained from RSGB Headquarters, 35 Doughty Street, London, England WC1N 2AE. Please include an SAE.

The general rules for RSGB HF contests, published in the January, 1982, issue of *Radio Communication*, will apply. Please note, however, that unmarked duplicate contacts will be penalized at 10 times the number of points claimed, and that logs containing in excess of 5 unmarked duplicate contacts will automatically be disqualified. Duplicate contacts should be included in your logs, marked as such, and without any claim for points.

Only RSGB members within the British Isles are eligible, while anyone else worldwide may enter. The only valid operating class is single operator.

EXCHANGE:

RS(T) plus serial number starting at 001.

FREQUENCIES:

Phone—7.04 to 7.1 MHz; CW—7.00 to 7.04 MHz.

SCORING:

Non-European stations with British Isles count 15 points per QSO. European stations with British Isles count 5 points per QSO. British Isles stations with European stations count 5 points per QSO, 15 points per non-European contact. British Isles stations may not work each other.

Multiplier for British Isles stations is the number of different countries worked—ARRL DXCC list applies. In addition, each VE, VK, W, ZL, and ZS call area counts as a country for this purpose.

Non-British Isles stations count one multiplier for each different British Isles prefix worked, maximum of 42. Please note that GB does not count!

Final score for all is QSO points times the total multiplier.

AWARDS:

The Thomas (G6QB) Memorial Trophy will be awarded to the leading British Isles entrant in the CW contest. Certificates will be sent to the entrants placed first, second, and third in the British Isles, European, and non-

CALENDAR

Feb 6-7	RSGB 7-MHz Contest—Phone
Feb 6-7	South Carolina QSO Party
Feb 6-7	Arizona QSO Party
Feb 13-14	WAS SSTV Contest
Feb 13-14	QCWA QSO Party—CW
Feb 20-21	ARRL DX Contest—CW
Feb 26-28	CQ Worldwide 160-Meter Contest—SSB
Feb 27-28	RSGB 7-MHz Contest—CW
Mar 6-7	ARRL DX Contest—Phone
Mar 13-14	QCWA QSO Party—Phone
Apr 17-18	ARCI QRP Spring QSO Party
Jun 12-13	ARRL VHF QSO Party
Jun 26-27	ARRL Field Day
Jul 10-11	IARU Radiosport
Aug 7-8	ARRL UHF Contest
Aug 14-15	European DX Contest—CW
Sep 11-12	ARRL VHF QSO Party
Sep 11-12	European DX Contest—Phone
Nov 6-7	ARRL Sweepstakes—CW
Nov 13-14	European DX Contest—RTTY
Nov 20-21	ARRL Sweepstakes—Phone
Dec 4-5	ARRL 160-Meter Contest
Dec 11-12	ARRL 10-Meter Contest

European sections of each contest.

ENTRIES:

Log sheets should be headed: date, time (GMT), callsign of station worked, RS(T) and number sent, RS(T) and number received, if multiplier, and QSO points claimed. A summary sheet is required showing the countries or prefixes worked. Each log must be accompanied by the following declaration: "I declare that my station was operated in accordance with the rules of the contest and in accordance with the terms of my license." The declaration must be signed and dated. Closing date for receipt of logs is April 3rd for the phone section and April 24th for the CW section. Address entries to: RSGB HF Contests Committee, PO Box 73, Lichfield, Staffordshire WS13 6UJ England. In the case of any dispute, the ruling of the Council of the RSGB shall be final.

RECEIVING SECTION:

Rules are generally the same, as applicable. British Isles entrants should log only overseas stations in contact with British Isles stations and must record the report and serial number given by the overseas station and the time in GMT. European stations logged count 5 points; outside Europe, 15 points. No more than 20 QSOs made by any one British Isles station may be logged.

Overseas listeners should log British Isles stations and must record the reports and serial numbers given and the time in GMT. European listeners claim 5 points per QSO logged; others, 15. A bonus of 20 points may be claimed for each British Isles numerical prefix logged. GB prefixes do not count, and not more than 20 QSOs made by the same British station may be logged.

ARIZONA QSO PARTY

Starts: 2000 GMT February 6
Ends: 0800 GMT February 7

Sponsored by the Arizona Amateur Radio Club. Each station may be worked only once per band.

EXCHANGE:

RS(T) and state, province, country, or AZ county.

FREQUENCIES:

SSB—1815, 3895, 7230, 14280, 21365, 28560. CW—1805, 3560, 7060, 14060, 21060, 28060. Novice—3725, 7125, 21125, 28125.

SCORING:

Count 1 point per SSB QSO and 2 points for each CW or "exotic" mode QSO. AZ stations multiply QSO points by number of states, provinces, and countries. Others multiply QSO points by number of AZ counties. The AARC club station W7IO also counts as 1 multiplier for non-AZ stations. Anyone working all AZ counties and W7IO may double the multiplier.

AWARDS:

Certificates for the highest scoring station in each state, province, country, and AZ county.

ENTRIES:

Show each station worked, RST and exchange, plus time and frequency. Include a summary sheet of your scoring and other information. Include a large SASE for results. Mailing deadline is March 6th and should be addressed to: AARC, c/o Gary Kent KB7VE, 16647 N. 34th Avenue, Phoenix AZ 85023.

SOUTH CAROLINA QSO PARTY

Starts: 1800 GMT February 6
Ends: 2359 GMT February 7

The QSO party is again sponsored by the Colleton County Contestors. The same station may be worked on each band and mode, simplex only. SC mobile stations that change counties are considered new stations. Novice and Technician stations please sign /N or /T.

EXCHANGE:

RS(T) and state, province, country, or SC county.

SCORING:

Phone contacts are worth 2 QSO points, CW contacts are worth 3 points. The multiplier for SC stations is the number of states, provinces, and DX countries worked. Others multiply QSO points by the number of SC counties worked (46 maximum).

FREQUENCIES:

Phone—3895, 7230, 14280, 21365, 28560. CW—3560, 7060, 14060, 21060, 28060. Novice—3725, 7125, 21125, 28125.

AWARDS:

Certificates to top-scoring station in each SC county, state, province, and DX country. Novices and Technicians compete only with other Novices and Technicians.

ENTRIES:

Include a summary sheet with your entry showing scoring and other information. Indicate each new multiplier in your log as it is worked. Novice and Technician indicate class on your entry. Include a large SASE for results. Mailing deadline is March 5th; send to: Colleton County Contestors, c/o Elliott Farrell, Jr. WA4YUU, PO Box 994, Walterboro SC 29488.

QCWA QSO PARTY—CW

Starts: 0001 GMT February 13
Ends: 2400 GMT February 14

This is the 25th annual QCWA QSO party with separate weekends for CW and phone. Contacts with the same station on more than one band can be scored only once. Contacts made with "captive" stations, such as when operating in local nets, are not valid.

EXCHANGE:

QSO number, operator's name, and QCWA chapter identification (official number or name). Members not affiliated with a chapter should use "AL".

FREQUENCIES:

Any authorized amateur frequency is permissible. The following suggested frequencies have been selected to minimize interference to others: 3530-3560, 7030-7060, 14030-14060, 21040-21070, and 28040-29070. These are selected as a starting place. When pileups occur, don't be afraid to go either side of these frequencies.

SCORING:

Each contact made with another QCWA member will count as a single point. This year's contest has two multipliers. The first is the same as in years past: each chapter is a multiplier of one. The second is that DX sta-

RESULTS

RESULTS OF THE 1981 OHIO QSO PARTY

Ohio Stations		**Score**
WB8MZZ		1,501,640
KB8EI		820,155
WB8JBM		666,000
WD8ALG		448,707
KA8HXX		428,736
KC8JH		339,000
KF8K		206,550
N8AKF		163,674
KA8IAH		148,830
KA8CTL		104,636
KB8AC		100,940
N8JJ		47,120
W8DXT		45,628
WA8WFX		39,285
WD8MCO		33,178
KB8WB		31,820
KA8IGM		31,620
WB8MIP		28,968
W8HFK		26,048
N8DCJ		23,408
N8BJQ		12,810
W8OJM		3,335
W8VPV (Club Station)		183,012
Out of State		**Score**
WA0AVL/9	IL	11,086
W4FOA	VA	10,480
KA2EPS	E NY	5,550
K9GDF	WI	4,008
W2EZ	W NY	3,900
KA8LPV	MI	3,810
K8EIO/3	MD/DC	3,430
NO4P	KY	3,360
WB3IET	W PA	3,240
W4OVT	GA	2,940
WB4ZPF	VA	2,875
N0CLV	KS	2,314
N1BDB	CT	2,180
W4KMS	VA	1,692
WB3FNS	MD/DC	1,628
N4CD	VA	1,552
KG9Z	IL	1,482
WB9CWE	IL	1,364
WA3JXW	E PA	1,232
WA3GNW	E PA	828
WB9NRK	WI	780
K2NC	W NY	737
WB1GLH	MA	672
W4LEP	TN	588
WA9MRU	IL	576
WB7TJI	ID	351
KA1VE	MA	340
N5AFV	OK	306
KA2EGO	N NJ	208
AK7J	ID	165
KF2T	N NJ	132
KB9TI	IL	90
K1BV	CT	50

QSL OF THE MONTH

Call us chauvinists, but the beautiful rendition of the New Hampshire countryside on this attractive card wins WB1GGQ his choice of any book in *73*'s Radio Bookshop.

Is your card a winner? To enter, place your card in an envelope along with your book selection and mail to *73 Magazine*, Pine Street, Peterborough NH 03458. Attention: QSL of the Month. To be eligible, your entry *must* be sent in an envelope and *must* be accompanied by your book selection.

tions are a multiplier of two. DX stations are defined as Europe, Africa, South America, Asia, and Oceania—the same as for WAC of ARRL. Contacts within your own country count only as a chapter multiplier. Final score is then the total QSO points times the sum of the number of chapters and DX stations worked.

AWARDS:

Plaques for the top phone and top CW scorers. Certificates will be given for the 2nd through 5th runners-up in both the phone and CW Parties. Standings and scores will be published in the *QCWA News*, issue of summer, 1982.

ENTRIES:

Logs should include the following information: time (GMT), call, QSO numbers, name, chapter number or name, state or country. It is the responsibility of each contestant to provide a legible log, no carbon copies, and to list all claimed contacts. The total contacts for each page will be recorded at the bottom of each page. The total contacts for the Party should be recorded at the top right of the first page of the log. Log sheets will not be returned. Make sure you have correct postage when you mail your logs. Send logs no later than March 31st to: Pine Tree Chapter 134, Glenn Baxter K1MAN, Long Pond Lodge, Belgrade Lakes ME 04918. Separate logs and scores must be submitted for the CW and phone parties.

Work as many QCWA members as possible and apply for the several special QCWA certificates which you have qualified for in the QCWA Parties: Worked 50 States, Worked 60 Chapters, Worked 100 Members, and Worked 500 Members.

WAS SSTV CONTEST

Starts: 0900 EST February 13
Ends: 2100 EST February 14

Sponsored by amateur television's *A5 Magazine*. Use all authorized and recognized SSTV operating frequencies within the HF bands. Attempt to work as many SSTV operators from other states as possible during the 36-hour contest period. The emphasis is on quality, not just quantity.

SCORING:

Count 25 points per contact with 10 bonus points awarded for live exchanges of "mugshots," color two-way contacts, or 256 or 128 (1/2-speed) mode transmissions. Add 100 points for each new state listed. Alaska and Hawaii contacts count a bonus factor of 500 points!

EXCHANGE:

Station calls and signal reports must be exchanged in video format by either camera, keyboard, or light-pen generators.

AWARDS:

First-place winnner receives a 3-year subscription (or renewal) to *A5 Magazine*, a framed Specialized Communication Certificate, and his photo published on the front cover of the magazine. Second- and third-place winners receive 1-year subscriptions and certificates. All contestants will receive gold certificates with submitted logs.

ENTRIES:

Submit actual or copies of contest log sheets by no later than March 1st to Contest Manager, *A5 Magazine*, PO Box H, Lowden IA 52255. Official results will be published in the May/June issue of *A5 Magazine*. Those winners attending the Dayton, Ohio, Hamvention will be awarded certificates at the regular ATV Forum meetings.

CQ WORLDWIDE 160-METER CONTEST—SSB

Starts: 2200 GMT February 26
Ends: 1600 GMT February 28

EXCHANGE:

RS plus a three-digit contact number starting with 001. US stations include state and Canadians include province.

SCORING:

US and Canadian stations count 2 points per QSO with other W/VE/VO stations; DX contacts are 10 points each.

DX stations count 2 points per QSO with stations in the same country and 5 points with stations in other countries. QSOs with W/VE/VO stations are 10 points each.

All stations count one multiplier point for each US state, VE province, and DX country. KH6 and KL7 are considered DX. Final score is total QSO points times the sum of multipliers.

AWARDS:

Certificates to the top scorers in each state, VE province, and DX country. Additional awards if the scores or returns warrant.

Two plaques are being awarded by the West Gulf ARC, both for single operators, one for the highest scoring US station and the other for Europe. The World Champion in the contest will receive the John Doremus WØAW Memorial Plaque from friends of WØAW. This plaque may be won only once by the same station in a three-year period.

PENALTIES:

Three additional contacts will be deleted from the score for each duplicate, false, or unverifiable contact removed from the log. A second multiplier will also be removed for each one lost by this action.

Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, or the rules of the contest, or unsportmanship conduct, or taking credit for excessive duplicate contacts or multipliers will be deemed sufficient cause for disqualification. Disqualified stations or operators may be barred from competing in *CQ* contests for a period of up to three years.

ENTRIES:

Sample log and summary sheets may be obtained from *CQ* by sending a large SASE with sufficient postage to cover your request. It is not necessary to use the official form; you can use your own. Logs should have 40 contacts per page and show time in GMT, numbers sent and received, and separate columns for QSO points and multipliers. Indicate the multiplier only the first time it is worked.

Mailing deadline for SSB entries is March 31st. Logs can be sent directly to the 160 Contest Director, Don McClenon N4IN, 3075 Florida Avenue, Melbourne FL 32901 USA. Alternatively, they can be sent to *CQ*, 160-Meter Contest, 76 North Broadway, Hicksville NY 11801 USA.

NEWSLETTER CONTEST WINNER

Humor is a key part of this month's newsletter winner. *The National Hampoon*, published by the Cleveland-based South East Amateur Radio Club, is chock full of puns, good-natured put-downs, and inside jokes. Editor KA8KTR is not above poking fun at himself or the 33-year-old club. Besides being fun to read, *The National Hampoon* provides a deluge of information about what individual club members are doing. Don't let your club's members fall into the trap of not reading each newsletter. Try adding some life and humor; the readers will anxiously await the arrival of the next issue.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

"This section shall not apply to receiving, divulging, publishing, or utilizing the contents of any radio communication which is transmitted by any station for the use of the general public; or which refers to ships, aircraft, vehicles, or persons in distress; or which is monitored pursuant to section 4(f)(6) and which is received, divulged, or used in any investigation or enforcement action by the Commission."

Explanation

This amendment conforms §605 to §4(f) to accommodate proposed language to permit use of volunteer monitors.

Here is another way that amateurs could help the Commission cut down on their costs. Not that they are spending a lot monitoring the ham bands these days anyway... and who needs 'em? But with the rules changed so that amateurs could set up a monitoring system, we would be able to clean up a lot of miseries which are now plaguing our bands.

We have tens of thousands of retired hams and several thousand more handicapped hams, all with loads of time on their hands and an eagerness to be of value. Well, here is a service that these hams could provide which would be priceless to us. I've talked with the FCC commissioners about this and they seem to be enthusiastic about the concept. You see, not only could hams be organized to monitor the ham bands, but they could also assist the FCC monitors in watching over some of the non-amateur bands, too.

If we once started getting into this monitoring idea, it would not be long before innovative hams would start coming up with automatic band scanners and receivers which would be connected to microcomputers and would program themselves to listen for unrecognized transmissions. With digital receivers and frequency counters, it is only one more step to a system which will keep track of what signals are okay on what frequencies and spot the anomalies quickly so they can be identified.

Not only would this be of great help for digging out emergency signals fast, but it would be even better protection against illicit transmissions involved with spying and drug traffic and so on. Coded transmissions? We have some mighty sharp ham cryptographers who would love to have challenges like that.

Why should the government spend wads of money doing something which we not only could do but probably could do better, and which we would enjoy doing?

Yes, a ham monitoring system would take some organization, but it wouldn't be difficult to handle. Much of the work could be done over the air, with unknown signals spotted and triangulated via a ham net. And with hams everywhere, even the UHF channels could be watched over in every part of the country. This would raise hell with crooks using CB or HTs on commercial channels to coordinate crimes. There would be no safe frequency or place in the country for them. Pity.

FRIENDLY CLUBS

Several letters from readers have made mention of a situation which I've noticed in some clubs I've visited...a lack of friendliness. Oh, it isn't intentional... but it is a drag. I suggest that club officers take a good critical look at the way their club is working and start doing something about it.

When someone new comes to a club meeting he (or she!) should be met by members and introduced around. Each person should have an identification badge so newcomers will know to whom they are talking. Members of the club should be aware that it is their responsibility to go out of their way to be friendly with any newcomers... to talk with them... show them around. Have the glad hand out.

When the newcomer arrives, try to find out about him... his call, if licensed... or if he is not yet licensed and might be interested in coming to the club license classes... what bands he works... and so on. Then get up at the meeting and introduce the newcomer and tell about his background so the others will know him. Make a big deal out of the newcomer and he will be back. You won't be able to keep him away with a stick.

In case you haven't noticed it, darned few hams are outgoing. The gregarious ham is unusual. Most hams are loners who may do just fine on the air, but are afraid to talk on a one-to-one basis. You should recognize this and gear your club meetings to overcome this situation. If you have a table where they can show their new and exciting QSL cards... that's a conversation breaker. Another table where they can show something they've built is another winner. Perhaps a spot to show off newly-purchased ham gear... stuff that is just recently on the market. Everyone is always interested in new rigs and gadgets. Anything you can work up in ways to get members showing and telling will break the ice and help everyone have a good time... and it is a good time at meetings which will bring 'em back alive next month.

This isn't the time to get into the details on how to run a ham club, but I will just touch on some of the basics. Remember that when you are running a ham club you are in show business. You want to keep for the board of directors as much of the dull business aspect of the club as you can, letting the meetings be times when you are entertaining the members.

What is entertaining? Well, demonstrations of unusual modes of communications are winners. You probably have someone in the area who is working with slow scan and can knock the socks off the members with color slow scan. Or perhaps some members are into computerized RTTY communications. Anything on 10 GHz? Any new antennas popped up which can be shown on a blackboard and explained? Slides of a Dxpedition are great fun.

How much do the members know of what is going on in the 450-MHz band? How about 220 MHz? Anyone working with SSB on 2m? How about aurora DXing, meteor-scatter DXing, moonbounce?

Manufacturers will go a long way to show their products when they have something new. Keep your eye on the new products section of *73* and see what you can generate. They want to show their products and they also want to get feedback from your members on possible new products. They need both the sales and the input.

DEREGULATION

The interest in deregulation by the Commission got started back in 1974, triggered by the *en banc* hearing at which a group of amateurs testified as to the need for deregulation. This turned out to be a matter of doing the right thing at the right time... as the Commission was just at that time getting interested in the concept. The hearing made clear the need for deregulation of amateur radio, and the Commission started with our service, intending to use it as an example of what could be done.

The hearing, by the way, was in response to the then-new regulations on repeaters, which were particularly onerous. Lacking any initiative from the ARRL, I got representatives together from repeater groups all around the country to testify before the Commissioners. If anyone is interested, I have a tape of this historical confrontation. The ARRL refused to participate, putting the effort down as naive and useless. The result was the biggest change in our rules ever brought about.

Of considerable significance is a recent paper (August, 1981) from the FCC. This is a working paper on deregulating the personal and amateur radio services. The paper is quite candid... surprising in its frankness. There are some interesting concepts... "many... agree that the goals of expanding technical skills and manpower and advancing the radio art have fallen on hard times in recent years." It goes on, "If there is criticism of amateurs for not being technically more advanced, it could be misdirected. Perhaps one should place some of the responsibility on the regulations, not the licensees. Substantially more regulatory flexibility than

the service now has would be desirable."

Frankly, that's an understatement.

The other day, on my way down to Florida to give a talk to a group of accountants who are using TRS-80 systems, I stopped by Tufts Electronics in Hudson, New Hampshire. Chuck recently moved from down near Boston to tax-free New Hampshire, thus saving nearby Massachusetts hams a bundle on their purchases. The new Yaesu FT-208R HT had just arrived, so I bought one.

As I punched up the channels on the synthesizer, programming the unit to scan several local repeaters and a simplex channel or two, I got to thinking about the whole two-meter US vs. Japan situation. Having been in the 2m ham field for over 40 years, I remember how things got started.

The first FM rigs were converted commercial systems, mostly by Motorola and G.E.—monsters, dumped on us when the commercial two-way specs were changed, rendering tens of thousands of taxi and police transceivers obsolete. Then came a rig from I.C.E. (in Texas) which never got to first base... mostly because it didn't work very well. The next try was from Galaxy (Missouri). Though unstable and much too large, it sold reasonably well. The engineering design was dismal. Ed Clegg, who had been building VHF equipment for us for years, came up with one of the better FM rigs of the time, but by then some of the Japanese equipment was starting to arrive.

Icom was designing very nice equipment, and it was selling well. Unfortunately, the company was taken to the cleaners by a crooked Arizona importer/distributor. Nothing daunted, Mr. Inoue, the president of the firm, came to the US and shopped around for a new importer. He also asked a lot of questions about what kind of new equipment was wanted... and listened carefully to the answers. The result was the IC-230, the first synthesized ham rig. Before that, the best-selling rigs were from Standard and featured ever more crystal sockets. I got to where I had to have hundreds of crystals on hand to cope with all of the repeaters going on the air... and the many different rigs.

Mr. Inoue said that he would some day be able to put a synthesizer into an HT for us. Well, we knew it would happen, but it seemed like a dream. You know, there was a small outfit out near Buffalo, New York, which came up with a synthesizer early in the game, but they never really followed up on it. It started out as a club project and then changed into a business. I think if they'd played their advertising right they could have developed into a large business by now with perhaps $50 million in sales.

Another firm which had a crack at it and dropped the ball was Vanguard, down on Long Island. Andre developed a synthesizer to plug into the older rigs, but didn't take it the next step.

It isn't really fair to put down US firms for losing the ball on FM equipment... or any other ham gear for that matter. You see, the Japanese went right on by us in the number of licensed hams, so their firms had a great advantage. Not only did they have more hams, but their hams were much more enthusiastic and active than we were. Amateur radio really took hold in Japan when they got rid of the Morse code requirement. Clubs sprang up in high schools all over the country, and today they have double to triple the number of active hams that we have. Further, their spirit is almost unbelievable.

Have you even thought of going on a DXpedition? Well, the Japanese have organized DXpeditions where they have had about 400 active hams going along and getting on the air! When you read the Japanese club magazine you find that it is packed for dozens of pages a month with pictures of club activities and outings. We don't appear to have a single club in the US which even comes close to the enthusiasm which has spread through Japan... at least I'm not familiar with any. I've asked several times for pictures of any outstanding club activities for publication in *73*... nothing yet.

One of the facts of business is that the more of the product you make, the cheaper it is to manufacture. When you double the production of a piece of equipment, the cost of making it goes down 15-25%. So this bunch of eager buyers in Japan has done two things to the ham equipment market. First, their enthusiasm has encouraged the Japanese firms to keep up a continuing development of new equipment. The volume of sales has forced American firms out of the market because the Japanese equipment has been both better and cheaper in most instances.

Where the shoe really begins to hurt is that we are now seeing the results of the over 500,000 Japanese hams and their enthusiasm. These chaps have now gone from high school through college, on into industry, and are wiping out the American consumer electronics industry. Their rate of graduation of engineers, technicians, and scientists has zoomed past ours.

In this respect, amateur radio has let America down. If you stop and think about it, most technical career people get started in their teens. By stopping the growth of amateur radio in 1963, with little since then, we have managed to kill off virtually a whole generation of technical people. Unless a person gets interested in electronics in high school, there is little reason for him to go into electronics as a career. So now we have a bunch of philosophy and liberal arts majors wandering around looking for work... while our electronics industry is getting wiped out by Japan.

There really isn't much we can do about the situation right now. We will be outgunned in technicians for some time to come. If we are going to get back into the driver's seat, we are going to have to figure out some way to get a whole generation of teenagers interested in technical careers. That's quite a challenge.

In the meanwhile, as I go further and further into the instruction book for the 208, I wonder what next in HTs. With the LCD display of the frequency, the 208 should have a substantially longer battery life than the 207. I like the scanning system... just what I've wanted for years, wherein it scans, stops on a busy channel for a few seconds, and then continues scanning. You can set it up for a priority channel... for instance, I generally monitor 147.540 for simplex calls. They've even made the battery compartment so that you can open it without a coin.

I picked up a mailing piece at Tufts which was rather clever... and sad. The headline on it was, "Where have all the amateur radio stores gone?" Then there are drawings of eleven graves with headstones for the eleven Greater Boston ham stores which have gone out of the ham business (or just plain out of business) in recent months.

With the recent even further drop in new licensees... down around 35%... ham stores all around the country are folding. The ones that seem to be failing the most are those which had little slogans such as, never undersold... call for low, low prices... 20% off... and so on. You know, unless we do something about all this, amateur radio will soon be little more than a retirement playground for elderly hams.

I admit to getting a bit frustrated when I visit some ham clubs and find that many of the members... old-timers, of course... are prepared to resist any efforts to bring in new hams as much as they can. They don't want the QRM... and they don't much enjoy talking to young hams... and don't want them trying to join their club. They would like to raise the code speed to 50 wpm and have everyone coming in pass the Extra class license exam... and then get restricted to the CW bands for a few years. They like *QST*, not *73*. These chaps are turning amateur radio from a friendly fraternity into an old farternity.

Apropos of the mention of the 1963 debacle, I looked back over my editorials and found that I had indeed predicted at the time that one of the results of the proposed rules change would be the demise of a great many dealers... and manufacturers. About 75% of the ham dealers

WARNING

Due to numerous complaints received from readers who have dealt with Electronic Specialties, Inc., of Miami, Florida, we have discontinued their advertisements and urge all readers to use caution when dealing with this firm.

went out of the ham business as a result . . . and most of the manufacturers. It's interesting to see the old ads for Hammarlund, Hallicrafters, National, Johnston, Squires-Sanders, Central Electronics, Lakeshore, Multi-Elmac, United Transformer, Stancor, Bud, Gonset, Polytronics, and so on. It sure wiped 'em out.

The 208 is a great rig . . . but it is not a breakthrough into anything really new. If we're going to get amateur radio pepped up, we have to get into the 80s and digital communications techniques. We really have nothing new to be excited about. FM is a bore for most of us . . . and heck, DX has been around for a lifetime. What have we that is really new and fun? We need something to get our juices flowing.

What have you got?

HAM WATCH REPAIR

Eventually, those Casio C-80 and C-90 watches run out of battery and need to get a battery refill. The replacement of the batteries isn't a really big deal . . . you can probably do it. Or, of course, you can fire it back to Casio for their $10 repair charge. Many jewelers are afraid of digital watches and claim they can't fix them. Tsk.

You can run into a problem with the Casio watches in that they often do not start when you replace the batteries. You have to short out the battery cover and a nearby metallic dot marked "AC" with a wire, tweezers, or even a paper clip to get the watch to start again. Jewelers have gotten instructions on this, but often just don't want to be bothered . . . or didn't read the instructions.

The C-80 and C-90 Casio watches, which I've written about before, are the ones which did the most to put both Texas Instruments and Commodore out of the watch business. Casio came out with a $50 watch which knocked the socks off everything else on the market. More and more of us around the magazine are wearing the C-90, beeping away every hour in unison.

My thanks to WB9OJD for the battery information on the watch.

GETTING RICH

Firms which are publicly held have a problem that privately owned firms don't have to worry about: making ever more money to keep the stock prices high.

This came to mind when I got a letter the other day . . . and not the first one . . . saying that the reason I want ham growth is so that I can make more money from *73 Magazine*. Let's take a good look at that cop-out.

First point. If I *were* interested in money, spending time on trying to get amateur radio growing would be one of the last ways I would invest my time. The real money today is in microcomputers, and the maximum return for hours spent is obviously in that field. Every time I start a new computer magazine, I generate a couple of million dollars more cash flow for us and bring employment to a bunch more people. I also help the microcomputer field to grow by virtue of the communications I bring about.

No, from a business point of view, I could care less whether amateur radio grows or not. If I were to fold up *73 Magazine*, we'd make more money using the people and facilities for the much, much more profitable computer publications. But I'd miss a lot of fun . . . and amateur radio would lose a lot of articles and enthusiasm.

Point Two. Even if we got into a great growth pattern and *73 Magazine* started to make a huge profit, the money would go toward my real goals, not to me. My goals are to provide education through my publications and through any other media available. If I had a million to spare right now, I would quickly put it into the development of Hawthorne-Green Institute, a college to teach electronics, communications, and computing.

I seriously doubt if many readers spend much less on themselves than I do. I do have to buy clothes so I look well, even if I begrudge the expense. That's part of being in business. My entire life revolves around the business. I grab breakfast at my desk, have a business lunch almost every day . . . or else I eat an apple and cheese at my desk. Dinners are often with advertisers, at ham clubs, computer shows, or on trips to visit manufacturers. I don't think my wife and I get together to eat dinner at home ten days a year. She, too, is wrapped up in our business, and we share a two-room apartment in the old house that is our headquarters building.

I'm serious about trying to get American technology back into the lead and I think I have the key to this. If you were in my shoes, wouldn't you feel that was a worthy goal? Further, I think it is a goal I can achieve.

Probably the "richest" time of my life was back in the mid-50s when I was the editor of *CQ* and also the president of a small hi-fi manufacturing firm. I made a big $15,000 at that time, which is a whole lot more than I'm making now in today's dollarettes. I was able to support a home, family, a seaplane, an Arabian horse, a small yacht, and two Porsches. One of the things which I learned was that toys like those own you, not the other way around. The horse had to be exercised every day . . . and trained. The Porsches needed constant service, most of which had to be self-provided. The damned yacht had to be scraped and painted every year or so, the engine worked on, and so on. The plane? You have no idea of misery until you own your own plane. It cost more per year to own and run than any two of the other toys. It was fun and I'm glad I did it, but I'm all over wanting yachts and planes.

Money has value only for what it can do towards my goals. If I can generate more, I can do more . . . and there is far more satisfaction in that than having a pocketful of hundred-dollar bills . . . or a bankful.

I have this dream of being able to help get amateur radio into more countries . . . as a way of helping those countries to grow. Countries have a desperate need for electronics and communications experts . . . technicians, engineers, and scientists. The best way, by far, for getting these needed people is via infection of teenagers with the virus of electronics . . . and that means amateur radio. It works!

If the United States is going to stay on top over the next generation or two, we need to invest in technical people. I'm working on that via my push to get amateur radio and computer clubs into every high school in the country. I'm also working on it via my Hawthorne-Green Institute concept . . . a college which is geared to the 1980s and 90s . . . one which will feature high-speed concentrated education in both technical matters and business. My aim is to provide the education which will bring us tens of thousands of entrepreneurs, all with electronics and computer backgrounds. Let's see *any* country get ahead of us then!

So, when someone puts me down as looking to make money, agree with them . . . and point out that so far I have a good record of investing that money for the benefit of amateur radio and computing . . . and, I hope you'll agree . . . for our country.

My ideas on how a college should be are spreading. I'm getting calls and visits from educators who are interested in the plan and who see it as a way to guide their schools into solvency in the next few years. With many private colleges failing, some radical change is needed. My talks on the subject in Brazil and South Africa brought great interest, with invites to come back and get together with government officials to further pursue the idea.

No, if I was into a personal fortune, one of the first things I would do would be to stop writing editorials, which I'm sure would immediately increase our circulation by about 50%. The next would be to stop my crusades, such as the very costly one twenty years ago to sell sideband to the readers—who hated it and felt that AM was the *only* way to go. Or the effort in 1969 to get amateurs interested in a little-known mode: NFM and repeaters. While I published hundreds upon hundreds of articles on repeaters and NFM, organized FM symposiums, put out a repeater bulletin, and dozens of books . . . the readers revolted, with about 20,000 dropping the magazine in disgust. Oh, most of 'em came back, sending me notes saying that, golly, I'd been right, sorry about that. But it was rough going for several years.

Not having a house or "family life" to take up my time, and not having a yacht, plane, horses, and dogs, I have the time to read so that I can keep up on computer technology . . . time to keep dozens of business projects going . . to personally use computers, video cameras . . . to go skiing occasionally, to travel . . . and even get on the air more than you might think. I have the time to write my editorials and even articles for other maga-

zines. I can get to Florida to give a talk on computers to an accounting group (expenses paid), to participate in a workshop on how to start special interest magazines (at the Folio show in New York). . . to get to South Africa and address data processing professionals on the impact of microcomputers. . .and so on. I do have to give up some things which are important to most people in order to do what I enjoy. . . pursuing my goal of education for as many people as possible.

It doesn't take money to do many of the things I do—just time management. I was able to set the 10.5-GHz record for states worked with borrowed equipment because I was willing to go up a damned mountain at all hours of the day and night for skeds. . .freezing my galuccis off.

Of course, if I get a lot of static about getting rich, I can always find some sucker to buy me out and go for a twenty-year sail around the world, charging $50 a contact to the Honor Roll hams, and live like a king. An enterprising ham can make $50,000 a year or more that way, as we have seen in the past.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

One of the fastest growing phases of RTTY these days, at least as evidenced by the questions I receive from readers of this column, is "computerized," or at least video, RTTY. More and more, the amateur is getting away from the old grease-monger of mechanical teleprinter and turning to one of the new microcomputer systems.

One of those systems hams appear to be turning to is the new Radio Shack TRS-80C(R), the so-called "Color Computer." Based on the powerful Motorola 6809 central processing unit, the TRS-80C appeals to the ham on many levels. Until recently, however, little was available in the way of RTTY software for this computer.

Now, Clay Abrams K6AEP, an author whose works are well-known to the readers of *73*, is offering some rather nice software for the TRS-80C at reasonable prices. Appealing to both the RTTY and SSTV enthusiast, Clay has put together some rather nice packages.

For the slow-scan television (SSTV) operator, Clay has three programs of varying degrees of capability. SSTV 7.2 converts the TRS-80C to an SSTV keyboard for sending frames of five lines each consisting of six characters. The next step up is SSTV 7.3, which expands the previous system to include an SSTV keyboard, color keyboard, video mixing, and joystick graphics. His ultimate system is SSTV 7.4, which allows gray-level picture transmission and reception, color-picture reception, tape-save ability, and many other features. The cost? SSTV 7.2 is only $20, and SSTV 7.3 and 7.4 are $30 each.

Not interested in SSTV, huh? Well, Clay has a few good RTTY programs, too! His bottom-line RTTY program, RTTY 7.01, allows RTTY transmission and reception in Murray and ASCII at all common rates. Three transmit buffers, an RY buffer, and a CW identifier are also provided. All this for $20. Clay's top-line program, RTTYCW, provides RTTY transceive, CW transceive, random code groups, split-screen display, multiple buffers, and tape saving. Requiring an external demodulator and CW interface, the program sells for the lofty sum of $30.

Interested? Drop Clay a line at Clay Abrams Software, 1758 Comstock Lane, San Jose CA 95124. Be sure to mention that you read about it in RTTY Loop, OK?

Interest in older machines is still around. Chuck Euola K8YPU, of Redford Township, Michigan, is using an Altair 680b. This M6800-based computer was introduced shortly after the Altair 8800, the "original" 8080 computer. Chuck is interested in receiving RTTY with his 680b, and wonders if some of the programs published to run with other 6800 systems will work. Other than changing the I/O address, the biggest problem you may have is with the slow speed of the 680b, as the clock runs at 500 kHz, roughly one half to one quarter of most other 6800 systems. However, you might try halving the constant in a delay loop, as calculated for a 1-MHz system, and then fine tuning as necessary. The program published in this column back in July, 1978, should work reasonably well.

Not everybody likes a computer, though. I have a letter here from Richard E. Christina, in Pahrump NV, who writes, "I need a transmitter strictly for RTTY. . .I would like about 200 Watts, 100% duty cycle, tubes, vfo. . .I do not desire to use a computer at this time."

Well, Richard, first of all, let's get our apples and oranges straight. The computer, if you use one, replaces the mechanical teleprinter, not the transmitter and receiver. No matter what method you use to display the RTTY signal, from an ancient Model 12 to a Whiz-Bang 6880 Micro-Term, you still need a transmitter, receiver (or transceiver), and antenna to get on the air.

Now, to the point of your question. A look through the back issues of *73* or any other amateur radio magazine or handbook will turn up many circuit descriptions for CW transmitters. Basically, that's all a RTTY transmitter is: a CW, i.e., continuous wave, transmitter in which the frequency determining element is modified by the digital RRY information. Adding that modification to the vfo, for example, involves a simple diode-capacitor combination, called a "shift pot," that we have covered in this column several times in the past few years.

As for the teleprinter itself, finding information on this machine or that can also take some doing. I have another letter here from K. D. Hardin KC5II, out in Albuquerque NM, who recently purchased a Teletype® Model 3320 and is looking for data on hooking it up. The 3320 is the "I/O" version of the Model 33, and is a very useful machine. This machine is designed to work in a 20-mA loop, and connection is via either a nine-position terminal strip or a twenty-pin plug, located on the back of the call control unit. This is the right rear corner of the machine, as you face it. Fig. 1 is a diagram of the nine-pin strip, terminal strip 151411, at the rear of the machine.

Unfortunately, not all Model 33s are alike, and minor differences in the call control unit can lead to major difficulties in hooking the machine up. Manuals are available from several sources; see the ads in this magazine for current availability.

I have a note here from Jeffrey A. Maass K8ND, who relates that RTTY DXers will have an opportunity to add Anguilla (VP2E) to their DX totals between February 23 and March 3, 1982. A group of contesters will travel to Anguilla to participate in the ARRL CW and SSB DX contests between February 15 and March 10,1982, and will be taking along a complete RTTY station. Amateurs using the calls VP2EV (QSL to K8ND), VP2EJ (QSL to WA8CZS), and VP2ED (QSL to

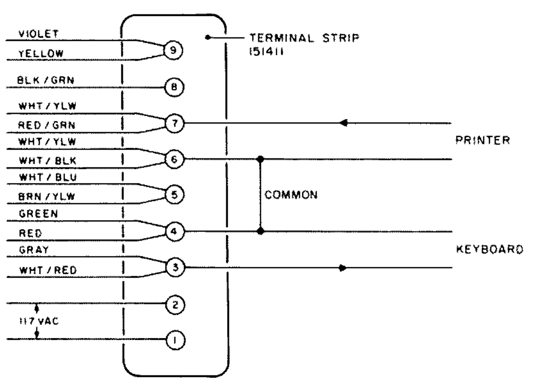


Fig. 1. Model 33 teletype hookup.

WB8VPA) will be operating in the time slot detailed above. Good luck!

By the way, the number of you interested in RTTY DXing does seem to be growing. Not only for two-way communications, but for looking for those rare press and commercial stations, too! Lt. Mike Anderson, with the U.S. Navy in Europe, is one of those folks. So I am happy to let you in on a little tip. A few months back, I mentioned Tom Harrington's book, *World Press Services Frequencies*, in this column. Available from the *73* Radio Bookshop at $5.95, this book contains listings of hundreds of commercial and governmental RTTY stations. One of the services promised by Tom was to keep buyers updated of recent "finds" and changes to the listing. Well, I have received his latest listing, and it is quite a gold mine for the individual interested in RTTY monitoring.

Well, this month brought Groundhog Day! Did the groundhog poke his head out of Baudot, see his shadow, and ASCII for six more weeks of winter? Who can say? (Murray can!) Find out here, in RTTY Loop!

NEW PRODUCTS

TEN-TEC 2-KW ANTENNA TUNER

Another first for Ten-Tec is a new 2-kW antenna tuner/swr bridge/power meter. The new tuner uses a reversible "L" configuration with a silver-plated roller inductor, high-voltage variable capacitor, and selectable fixed capacitors for greater versatility in impedance matching. The design automatically provides a low Q minimum loss path when properly adjusted. Power ratings are 2 kW PEP and 1 kW CW. Frequency range is 1.8-30 MHz. Model 229 matches conventional 50-Ohm unbalanced outputs of transceivers or linear amplifiers to a variety of balanced or unbalanced load impedances. Antennas such as dipoles, inverted "V"s, long random wires, windoms, beams, rhombics, mobile whips, Zepps, Hertz, and similar types can be matched. A built-in balun converts one antenna to a balanced configuration if desired.

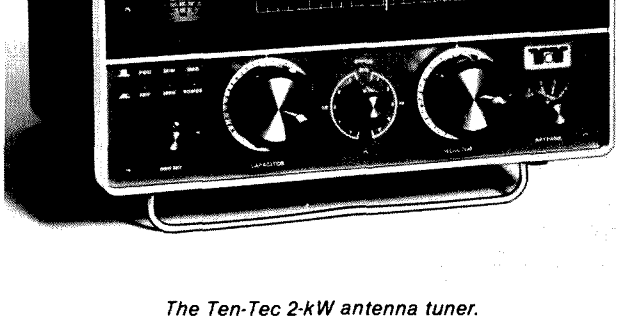
The built-in swr bridge and dual-range power meter indicates swr from 1:1 to 5:1 and power from 10 to 2000 Watts.

Front-panel controls are variable capacitor with spinner knob, roller inductor with spinner knob, 11-position bypass/hi-lo capacitor select switch, 4-position antenna selector switch, swr sensitivity, forward/reverse switch, 2000/200-Watt power range switch, and swr/power meter switch.

Rear panel includes coax input connector, four coax antenna connectors, three thumbscrew-type connectors for single wire and balanced line, ground connector, and 12-V dc input for dial lighting power.

Styling matches the Ten-Tec Omni transceiver and Hercules linear amplifier with black and bronze front panel with blackout lighting, satin-finish wraparound aluminum bezel, black textured vinyl-clad aluminum clamshell top, and bottom with fold-down stainless steel bail. Size: 6½" H × 12¾" W × 13½" D. Wt.: 9 lbs.

For full information, write *Ten-Tec, Highway 411 East, Sevierville TN 37862.*



The Ten-Tec 2-kW antenna tuner.

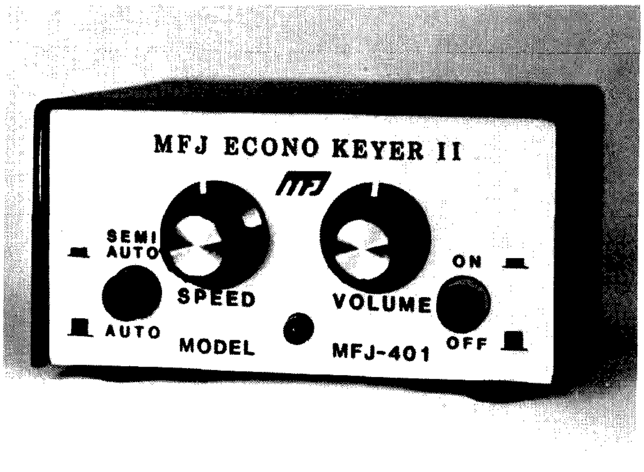
MFJ-401 AND MFJ-405 ECONO KEYER II

The MFJ-401 and MFJ-405 Econo Keyer II from MFJ Enterprises is a new full-feature economy keyer using the Curtis 8044 IC for reliability. The MFJ-401/405 *Econo Keyer II* has a much easier to use design and layout than the old Econo Keyer line. All controls are located on the front panel where they are easy to find and use.

The MFJ-401/405 Econo Keyer II has front-panel controls for both speed and volume. The on/off switch and auto/semi-auto switch is on the front panel. This switch lets you use the Econo Keyer II like a bug or it can be used to make tuning more convenient. A red LED indicates when the MFJ-401/405 Econo Keyer II is on. It may be used with an internal 9-volt battery or any source of 5-9 V dc. Circuitry is provided for both grid block and direct keying. This features lets the keyer work well with tube-type and solid-state rigs.

The MFJ-405 Econo Keyer II has a built-in clear lucite paddle and a jack on the back for an external iambic paddle. The MFJ-401 does not have a built-in paddle, but all other features are the same.

For more information, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 478.

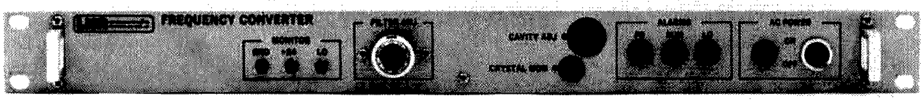


The MFJ-401 Econo Keyer II.

LNR DOWNCONVERTER FOR SATELLITE COMMUNICATIONS

The new Model DC4-E1 is a high-performance, low-profile rf to i-f converter especially designed for small terminal satellite Earth stations. Available in single thread and redundant configurations, this unit offers low phase noise and good frequency stability for digital and voice carriers, such as QPSK and FM-SCPC. The DC4-E1 is compact, measuring only 1-3/4" in height, and is designed for 19" rack mounting. Interfaces are coax connectors, so that the signal may be carried on low-cost coaxial cable. FET LNA power on the rf input connector is available as an option.

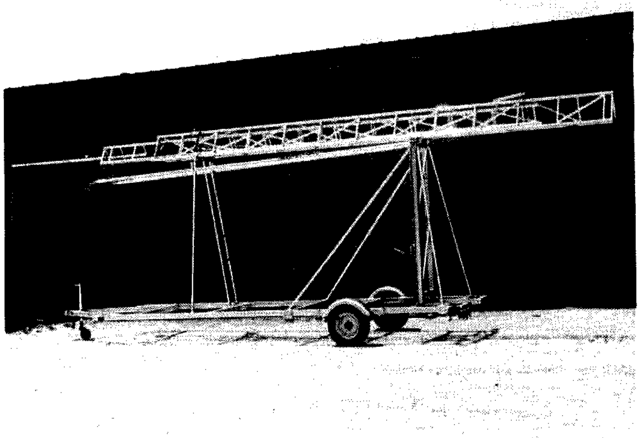
Low translation phase noise is ensured by an internal crystal-controlled phase-locked oscillator. Additionally, designed optimization ensures minimal intermodulation distortion. Each converter module is self-contained, including power supply. The unit is designed for unattended operation and has a remotable summary alarm and front-panel monitors for key operating parameters. LNR is a



The LNR frequency converter.

leading manufacturer of telecommunications equipment for satellite Earth stations.

For more information, please contact *LNR Communications, Inc., Marketing Department, 180 Marcus Blvd., Hauppauge NY 11787.* Reader Service number 480.


The Aluma Tower trailer.

NEW TOWER TRAILER

For those special situations that require communications tower mobility, Aluma Tower Co. introduces an all-steel trailer for transporting and erecting any Aluma Tower Co. aluminum or steel tower. Ideal for Field Day, civil defense, remote signal testing and many other situations, the tower/trailer combination is easily towed. Once in place, the tower is tilted up and cranked into position. The trailer acts as a secure base.

For more information, contact *Aluma Tower Co., 1639 Old Dixie Highway, Box 2806, Vero Beach FL 32960.* Reader Service number 482.


The HAL portable RTTY/CW terminal.

PORTABLE RTTY/CW TERMINAL

HAL Communications Corp. is pleased to announce the new CWR685A Telereader portable RTTY/CW terminal. Featuring compact size and 12-V dc operation, the CWR685A is just the thing for the traveling RTTY amateur who wants to "take it with him." A green phosphor 5" display is built into the small 12-3/4" × 11" × 5" main cabinet, as is a RTTY modem for 3 shifts, both "high" and "low" tones. The keyboard is separate and connects with a 3-foot cord to the main unit. Advanced features such as programmable HERE IS messages, type-ahead transmit buffer, and automatic transmit-receive control are included with the Telereader. The CWR685A can easily be slipped into a suitcase for a ham outing. In the home shack, the Telereader consumes little space and can be connected to an external monitor and parallel ASCII printer for even more versatility.

For more information, contact *HAL Communications Corp., Box 365, Urbana IL 61801.* Reader Service number 479.

SUPERCW

Frontier Enterprises has introduced SUPERCW, a computer-aided instruction program for the TRS-80 Model I or III microcomputer. Sound and graphics are combined to teach the user International Morse Code. By progressively increasing the copy speed, SUPERCW brings the user to 20 words per minute in as little as 72 hours of practice.

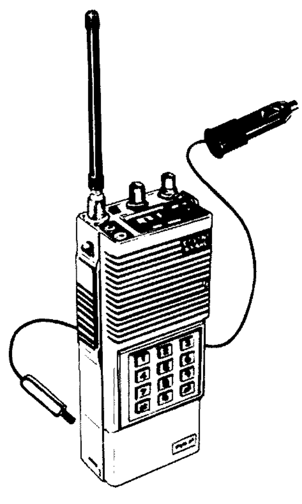
The disk-based SUPERCW package requires a 32K, 1-disk system. Features include random or plain text practice, sample testing, and provision for multiple users. For more information, contact *Frontier Enterprises, 3511 Gallows Road, Falls Church VA 22047.* Reader Service number 483.

MOBILE HT CHARGER

Mobile amateurs can operate and recharge their hand-held radios anytime with the new HT Power-Charger™ from Valor Enterprises. They simply insert the charger into the lighter socket and attach the mating plug to the radio. It will charge hand-held radios in less than an hour. The HT Power-Charger is not just a dropping resistor and diode, but a pair of transistors in a variable current regulator that is self-adjusting depending on the batteries' state of charge.

Mobile amateurs will appreciate the convenient package—all circuitry is enclosed in the plug with no box dangling on the cord. The HT Power-Charger features a built-in LED to indicate lighter socket function, with a five-foot connecting cable and plug to mate with the radio. There are six models designed to fit most popular amateur hand-held radios.

For more information, contact *Valor Enterprises, Inc., 185 W. Hamilton Street, West Milton OH 45383.* Reader Service number 481.


Valor Enterprises' mobile HT charger.

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '82 issue must be in our hands by February 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

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Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	7	7	7	7	7	7	7	7A	14	21	21A
ARGENTINA	14A	14	7	7	7	7	14	21A	21A	21A	21A	21A
AUSTRALIA	21A	14	7B	7B	7B	7B	7B	14	14	14	21	21A
CANAL ZONE	14	14	7	7	7	7	14	21	21A	21A	21A	21
ENGLAND	7	7	7	7	7	7	14	21A	21A	21A	14	7A
HAWAII	21A	14	7	7	7	7	7	7	14	21	21A	21A
INDIA	7	7	7B	7B	7B	7B	14	14A	14	14B	7B	7B
JAPAN	14A	14	7B	7B	7B	7	7	7B	7B	7B	14B	21A
MEXICO	21	7A	7	7	7	7	7	14	21A	21A	21A	21
PHILIPPINES	14	7A	7B	7B	7B	7B	7B	7	7	7B	14B	14
PUERTO RICO	14	7	7	7	7	7A	14	21	21A	21A	21	21
SOUTH AFRICA	14	7	7	7B	7B	7	14	21A	21A	21A	21	21
U. S. S. R.	7	7	7	7	7	7B	14	21A	21	14	7B	7B
WEST COAST	21A	14	7	7	7	7	7	14	21	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	7A	7	7	7	7	7	7	7A	14	21	21A
ARGENTINA	21	14	7A	7	7	7	7	21	21A	21A	21A	21A
AUSTRALIA	21A	14A	14	7B	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	14	14	7	7	7	7	14	14	21A	21A	21A	21
ENGLAND	7B	7	7	7	7	7	7B	21	21A	21	14	7B
HAWAII	21A	21	14	7	7	7	7	7	14	21	21A	21A
INDIA	7B	14	7B	7B	7B	7B	7B	7B	14	7A	7B	7B
JAPAN	21A	14	14B	7B	7B	7	7	7	7	7B	14	21A
MEXICO	14	14	7	7	7	7	7	14	14	21A	21A	21
PHILIPPINES	21A	14	7	7B	7B	7B	7B	7	7	7B	14B	14A
PUERTO RICO	21	14	7	7	7	7	7A	21	21A	21A	21A	21
SOUTH AFRICA	14	7A	7	7B	7B	7B	7	14	21A	21A	21A	21
U. S. S. R.	7B	7	7	7	7	7B	7B	14	21A	14	7B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21A	14	7	7	7	7	7	7	7	14	21	21A
ARGENTINA	21A	14A	14	7	7	7	7B	14	21A	21A	21A	21A
AUSTRALIA	21A	21	14	7A	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	21	14	14	7	7	7	7	14	21	21A	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	7A	21A	21	14	7B
HAWAII	21A	14A	14	7	7	7	7	7	14	21	21A	21A
INDIA	14	14	7B	7B	7B	7B	7B	7B	14	7A	7B	7B
JAPAN	21A	21A	14	7B	7	7	7	7	7	14B	14	21A
MEXICO	21	14	14	7	7	7	7	14	14A	21	21A	21A
PHILIPPINES	21A	21	14	7A	7B	7B	7B	7	7	14	14	21
PUERTO RICO	21	14	7A	7	7	7	7	14	21	21A	21A	21A
SOUTH AFRICA	14	7	7	7B	7B	7B	7B	14	14A	21A	21A	21
U. S. S. R.	7B	7B	7	7	7	7B	7B	7B	14A	14	7B	7B
EAST COAST	21A	14	7	7	7	7	7	14	21	21A	21A	21A

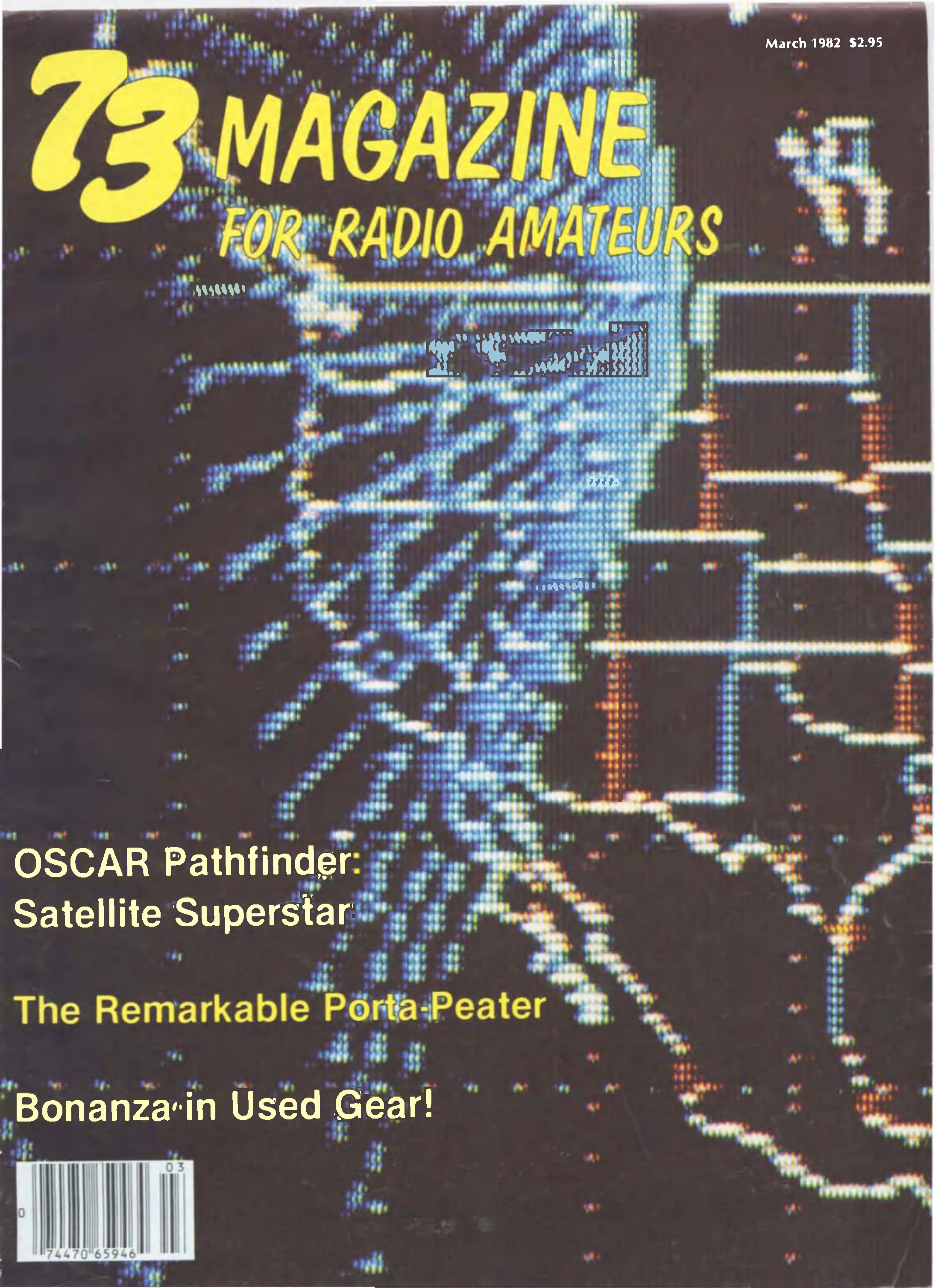
First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair G = Good
P = Poor * = Chance of solar flares; # = of aurora

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G/G	2 G/G	3 F/F*	4 F/F*	5 F/P	6 G/F
7 G/F	8 G/F	9 F/F	10 G/G	11 G/G	12 G/G	13 G/G
14 G/F	15 G/G	16 G/G	17 G/F	18 F/F	19 F/F	20 G/G
21 G/G*	22 G/F*	23 P/P	24 F/P	25 G/F	26 G/G	27 G/G
28 G/G						

March 1982 $2.95

73 MAGAZINE
FOR RADIO AMATEURS

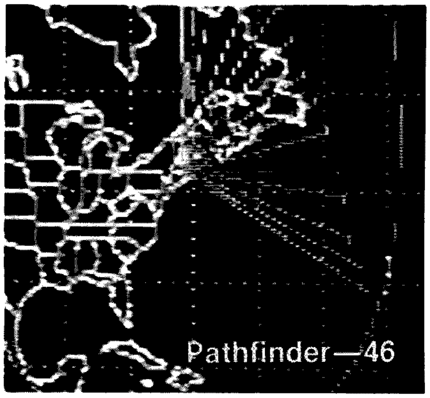


OSCAR Pathfinder:
Satellite Superstar

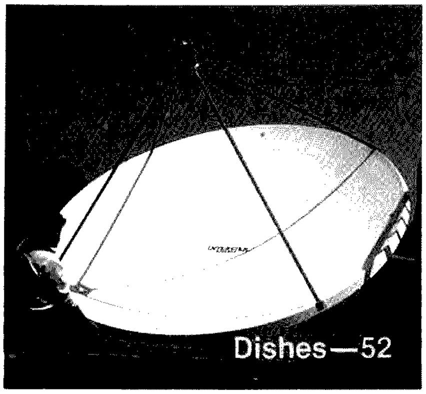
The Remarkable Porta-Peater

Bonanza in Used Gear!

mar. 82
73 MAGAZINE



Pathfinder—46



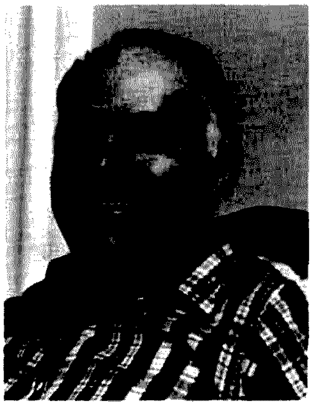
Dishes—52

FT-680R—142

Cover: Harold Nelson's photo depicts WB6NQK's OSCAR Pathfinder program (page 46) being used to track Russian satellite RS-6 (page 120).

W2NSD/1
NEVER SAY DIE

editorial by Wayne Green



MORSE AND THE DEMISED PLAIN LANGUAGE RULES

The FCC would probably have been able to get amateurs to buy the proffered plain language rewrite of the ham regulations but for one major miscalculation. Sure, there were some aspects of the rewrite which were in need of repairs, but the one disastrous flaw was so enormous in the eyes of amateurs that it sank the whole project. This was the deletion of 97.1, the Basis and Purpose of amateur radio.

All amateurs, whether walking around with an HT on the hip monitoring the local repeater or adding to the mess on 20 meters with fruitless calls in the pileups, are proud of the fundamental reasons for the existence of our hobby...or service, as the government likes to call it. When the FCC tampered with those magic words, they brought us out of our corner fighting.

Well, let's take a look at the words...and the concepts involved. Let's think about them in terms of our own personal contribution to amateur radio and see how we measure up. Let's also mull over the place of Morse code in this realm.

97.1(a) bids us to provide a noncommercial communications service, particularly with respect to emergencies. Fine. Some of us do that on occasion. Others make a career out of it. Well, we don't need a half-million active message handlers either during or between emergencies. We do need enough traffic-handling training so that whatever amateurs happen to be selected for an emergency situation by chance know what to do efficiently.

There is a tendency to think of traffic handling in terms of the CW nets which pass around endless streams of make-work messages, racking up traffic-handling scores for listing in *QST*. If we are going to be more honest about this, we have to admit grudgingly that when the chips are down, the emergency communications for most situations are handled on phone via two meters and repeaters... something few amateurs have had any real emergency experience with. One of the results of this is a pathetically slow traffic flow, with high percentages of the time wasted in callsign exchanges, the endless repeating of words spelled out letter by letter, and the jamming of transmissions by operators unfamiliar with emergency traffic handling.

If you stop to think about it, we are years beyond the time when we should have established a nationwide automated traffic net on high-speed ASCII which would route and pass along messages without any operator being needed. The resistance, right from the beginning, of the traffic organizations to the use of RTTY has kept this part of our "service" about 30 years behind technology. A group of us developed and were using automated message-handling techniques in the late 1940s, only to find a fierce resistance from the national relay organization to any changes from CW.

For emergency purposes, where two meters is the optimum band for local communications, we need hand and mobile phone rigs, not Morse code. With all due respect, there are times when it is advantageous to have a working system which even a CBer can step in and use if needed. Trying to stick to code for such communications is featherbedding.

If we are ever going to set up any serious emergency traffic-handling system in this country...or the world (why think small?)...it is going to have to be up-to-date. This means that we are going to have to think in terms of digital electronics and microcomputers, with automatic message pickup and relaying and with error-correcting codes which will ensure 100% copy at all times.

Indeed, if we start working on the elements of such a system now, I believe that within five years amateur radio can have an emergency communications system of which we can be proud. Such a system, if it is to work when really needed, must be in everyday use. Only in this way can we encourage the investment in equipment and technology which is required ...an investment by amateurs, not the government.

You know, if the worst should happen, our country could well be up the creek if we don't have a comprehensive system. I'm talking about automatic polling of stations in a net by the net control, with all messages typed in on a pocket-sized computer. I'm talking about relaying via repeaters, via satellites (ham and commercial), and via low-band links over any desired distances.

One of the last things we need in an emergency is to have to depend on the handful of hams who are good sharp Morse code operators. You know as well as I that at least 90% of the hams today are not capable of copying code at a reasonable speed under emergency conditions. Who are we trying to fool?

So much for 97.1(a)...though I will be writing more about our responsibility to catch up with technology for traffic handling and emergency nets. Let's look at 97.1(b) now...which has to do with the amateur contributing to the advancement of the state of the radio art. Well, we've a good history of that, if you look back far enough. In recent times we have little of which to be proud. Admittedly a good part of the responsibility for this lies with the FCC's restrictive regulations and inflexibility. But that isn't the whole story by any means.

Let me ask this...where does Morse code fit in any picture of the advancement of the radio art? Other than harking back to the beginnings of radio communications...before radiotelephone was invented...code plays little part in modern communications. Advancing technology has to do these days with digital techniques, with satellites, with microwaves, with high-speed communications, and many other possible new modes of communications. Revering our roots is one thing,

CALL FOR ARTICLES

Are you a RTTY, SSTV, or fast-scan TV enthusiast? Share your knowledge and enthusiasm with the rest of us by writing an article about your favorite mode. We are planning several special issues for later this year, so get cracking. Send your submissions to: Editor, *73 Magazine*, Pine Street, Peterborough NH 03458.

$$ HOME-BREW CONTEST $$

You can win a cash prize and receive fame and fortune by being a published author, all for telling us about your latest home-brew project. See the rules on page 6 of the February, 1982, issue of *73* for the rest of the story.

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but making a fetish of it is something else.

If we are going to live up to 97.1(b), it is about time that we shelved the code concept and encouraged amateurs to start building, experimenting, and pioneering new ideas. It is time we got behind the magazines pushing this concept. It is time we got these ideas into our clubs and discussed them.

I would love to print technical breakthrough articles as I did in past years. I still remember the Bill Ashby article on the Flying Nose Lock . . . the Costas articles on double sideband, years ahead of his time only because amateurs failed to take the bait and run with it . . . the parametric amplifier by Sam Harris, an invention which changed the long-range radar picture worldwide.

97.1(c) is a "rule" which is directed at the Commission, not at amateurs. Pity, for this is one of the most broken rules in our regulations. This one asks the FCC to encourage and improve the amateur service through rules which provide for the advancing of skills in both communications and the technical phases of the art. We've never had it so bad. If we had had any real national organization, it would have taken the FCC to court and sued in the name of the United States for several billion dollars . . . which is what has been lost due to the restrictive way the Commission has handled the amateur service . . . and totally ignored this rule.

Indeed, our country has lost many billions just as a result of the inept handling of the "incentive licensing" proposals of 1963. How much business has our country lost to Japan in television, radio, and other electronics equipment in the last few years? We are about one million engineers and technicians behind, today, as a result of that proposal—as I've beefed before.

Let's move on to 97.1(d) in our search for some ray of hope for a need for code. This one has to do with our providing a reservoir of trained operators, techni-

Continued on page 118

Well . . . I Can Dream, Can't I?

by Bandel Linn K4PP

"We recognize your service to the community as a ham! Therefore, your bill is cut in half!"

Reader Service for facing page ←303→

The Porta-Peater— the Instant Communicator

—quick and easy does it

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Lake Tranquility
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Lake Tranquility
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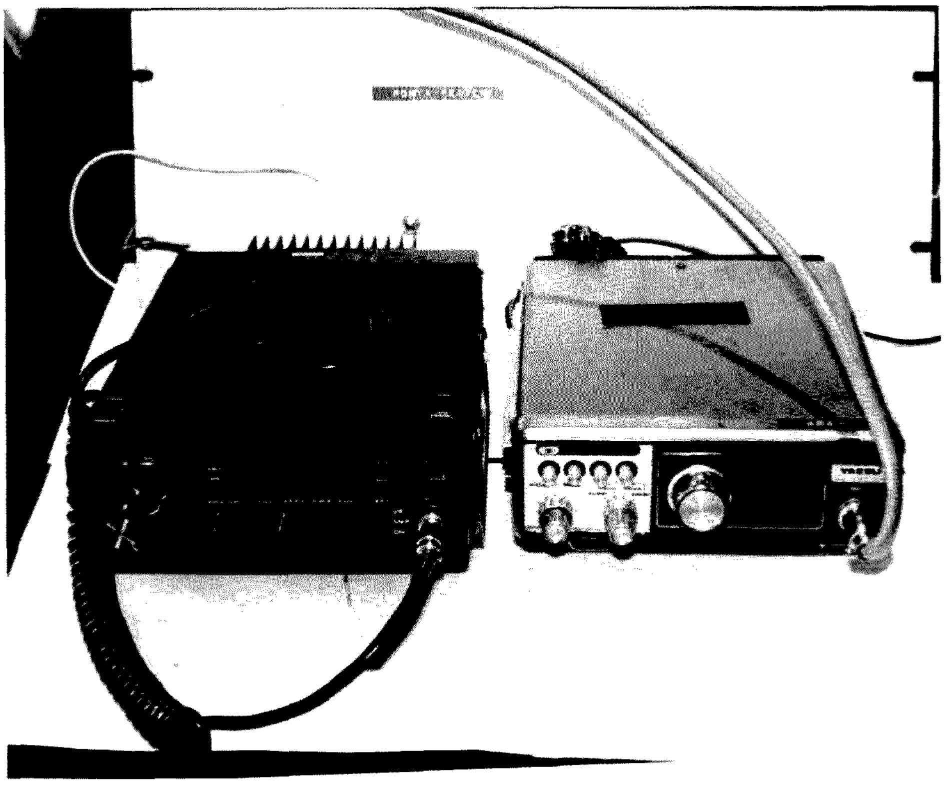

Photo A. Field Porta-Peater hookup with FT-227 and Tempo VHF-1. This Porta-Peater is housed in a minibox on a 19" rack panel (original prototype).

Emergency situations always seem to happen where there is limited repeater coverage available or limited HT range, or when no one's HT has a crystal frequency which matches anyone else's (sound familiar?). The Porta-Peater™ solves these problems and provides capability and versatility beyond any commercially-available repeater package—and for a lot less money.

The system is an audio-driven command and control module which takes any two rigs and converts them into a QRP, frequency-agile, VOX-driven repeater with CW IDer, hang, and cycle timers. All this with absolutely NO modifications to any of the radios. All connections are made via the available audio input and output jacks on the radios. You can run any mode, any band, cross band, etc. Do whatever your heart desires! You are limited only by your imagination and the FCC for Porta-Peater applications.

A complete Porta-Peater should run you less than $100 for all new parts including an enclosure (but no printed circuit board).

Photo A shows a Porta-Peater field repeater in action. Notice the simple installation. This one is set up on two meters.

Birth of Porta-Peater

The idea for Porta-Peater came from AC2A's desire to be able to erect an instant repeater at hamfests on a frequency fitting most of the HTs in use that day. Since one could never be sure who would be along on the day of a hamfest, there was no way of knowing whose rigs would be available to build into a temporary repeater. This meant no modifications could be made to anybody's unit. Also, we were too cheap to want to invest $600 in a fixed-frequency repeater for what basically was just playing around.

Photo B shows the first Porta-Peater. It was a simple control system with IDer capability but limited timer ability. It was set up at a local Philadelphia hamfest using a Tempo VHF One-Plus, a Yaesu FT-227R, and two separate Larsen 5/8-wavelength antennas about fifty feet apart (one on the ground, the other about 10 feet up). Both rigs were set to low-power output. Fantastic! Everybody liked it and used it. We switched frequencies, splits. You could do whatever you wanted, with limitations depending on what rigs you used, not the repeater control.

Passersby suggested using split band/mode, etc., and its application to emergency usage. This thing was really *more than* just a toy. It had the makings of being the basis for an instant emergency repeater system, with super possibilities. With the Porta-Peater, you could put a repeater on the air as fast as you could hook up two audio cables and two antennas.

Porta-Peater I was a hand-wired, non-reproducible model with diode matrix IDer. Definitely not the stuff articles are made of. It was ugly, but it did work and work well. Porta-Peater II had a nice PCB layout with a new PROM CW IDer. It looked good, worked lousy. Six months (part-time, with spurts of midnight-oil genius) were spent creating Porta-Peater III which looks good, works well, and is capable of being reproduced by other hams. Photos C and D show a boxed unit, and Photo E shows a rack-mount version.

Theory of Operation

The basic concept behind the Porta-Peater was the creation of a repeater by taking any two readily-available amateur radios. One rig acts strictly as a receiver and the other as a transmitter. Fig. 1 is a schematic representation. One rig (any band/mode) receives an incoming signal; it is taken off the external speaker jack and fed into the Porta-Peater. Here it is amplified, and the audio is used to trigger the other rig's transmitter (any band/mode) line via the Porta-Peater VOX. Incoming audio also starts the time-out timer. A separate internal timer controls the CW IDer cycle. Porta-Peater is an interface link between the audio output jack of one rig and the microphone jack of the other rig.

If you use two 2-meter rigs, a duplexer is not necessary since separate TX and RX antennas work quite well with about 40 or so feet between them at QRP levels. The quality of the particular rigs in use (front end specs) determines individual antenna-spacing requirements. Also, since the emergency usage of the Porta-Peater is based on the fact that you don't know in advance what bands on which you may be setting up a repeater (6, 2, 1-1/4, 3/4, etc.), a carload of duplexers in one's back seat generally is not appreciated by the family. Also, it ain't cheap!

The Porta-Peater would be extremely effective in hooking up a VHF link into a low-band rig command center via a repeater, with easy crossband communications. Since the system is VOX driven, you could create multiple-rig and repeater systems in any configuration needed. Just keep a supply of audio jumper cables handy.

Circuit Description

The Porta-Peater circuit is composed of six basic functions: a local mike amp, VOX amplifier, VOX trigger, reset timer, ID timer, and a selectable four-message PROM CW IDer. All circuit symbols are on Figs. 2 and 3. Audio from a receiver source is fed into an input transformer (T1), which provides a voltage transformation of 5-to-1 to drive the LM 3900 amp (section U1A), and the audio input of the transmitter. The LM3900 is a quad Norton current-mode amplifier. U1A and U1B form the VOX system. The VOX also can be triggered by closing the local PTT contact, which removes U1A pin 3 current bias and turns the VOX on. R2 and C1 form the hang-timer components for VOX hold-in.

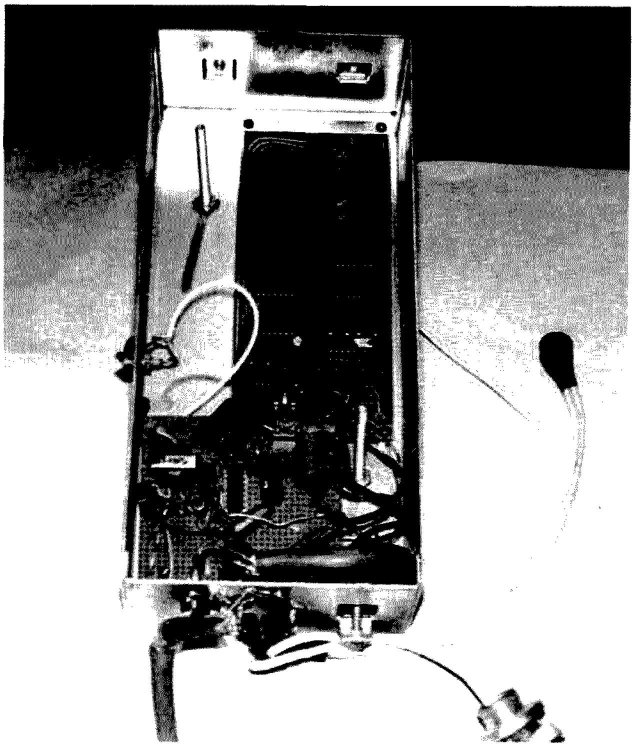

Photo B. Inside view of first unit from Photo A. CW IDer takes up most of box. Control system is in front.

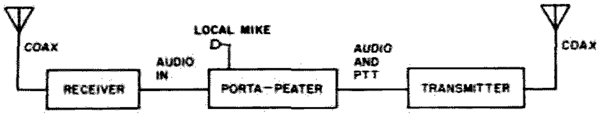

Fig. 1. System layout shows how simply a portable system can be constructed.

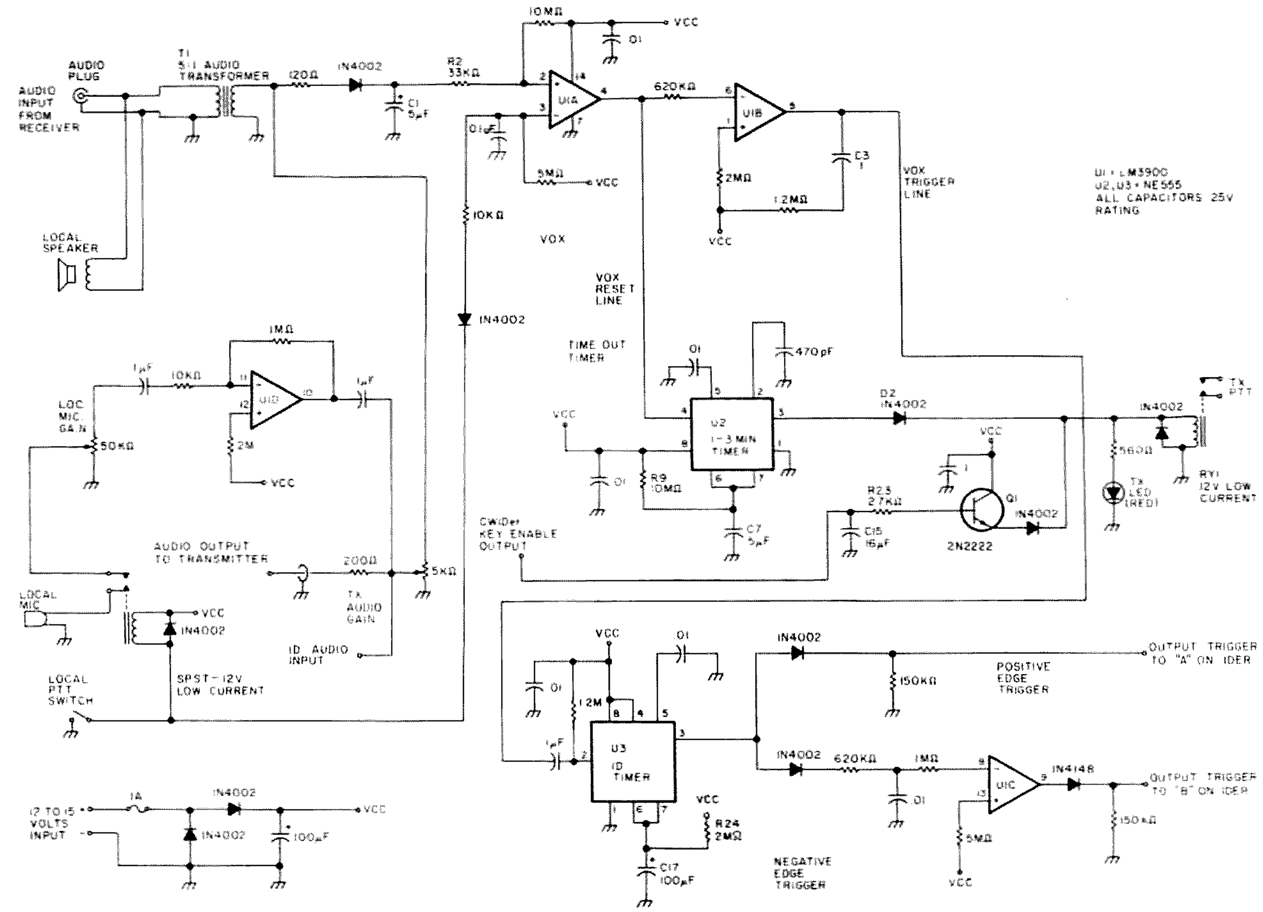

Fig. 2. Schematic of command and control logic for the Porta-Peater.

U1A output is normally low, which defeats the 555 timer, U2. The presence of an audio signal at U1A pin 2 shifts pin 4 to Vcc and enables the timer. U1B inverts the audio signal and provides a negative pulse through C3 and triggers U2 on, which is the 1-minute (adjustable via R9 and C7) time-out timer, and drives PTT relay RY1 on. Time-out timer U2 resets every time the VOX reset line goes low. D2 serves to isolate U2 from spikes due to RY1 operation.

Q1 is a relay driver driven by the CW ID source. The emitter follower is held reasonably high between ID pulses by R23 and C15. The 5-minute ID timer (adjustable via R24 and C17) is keyed by the VOX but is not reset by the VOX. When the 5-minute timer runs out, if

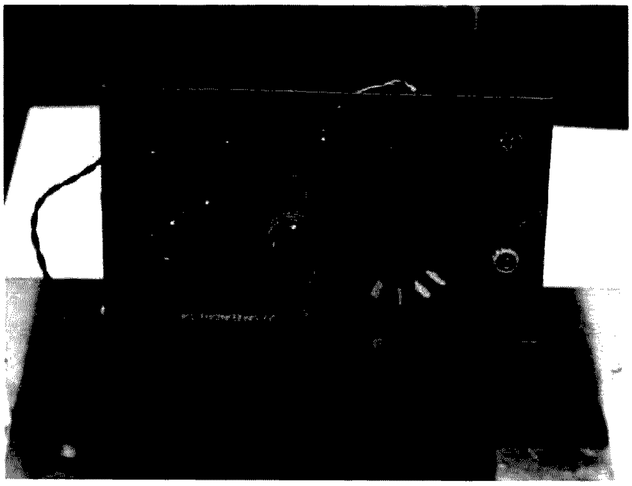

Photo C. Front view of the third version unit with four selectable IDs.

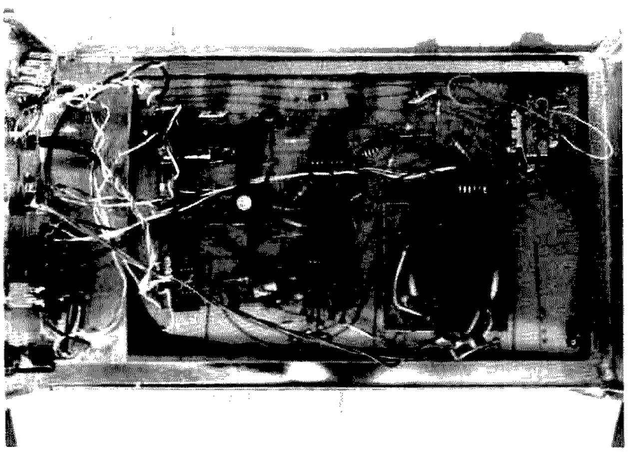

Photo D. Inside view of the same unit shown in Photo C.

the Porta-Peater is not in use, U1C inverts the falling pin 3 pulse and provides a positive trigger output to turn on the CW IDer, which in turn drives Q1 on and turns on the transmitter for the final ID as required by the FCC.

The CW IDer is based on an 82S126 PROM, which is a 4-by-256 device. In the PROM, 1 bit is a dit and space, 3 bits a dash and letter space, and 7 bits a word space. The message is played back from memory by being sequentially addressed by the 4020 binary counter driven by one half of the 4011 in an oscillator mode. The particular 256-bit message grouping is selected by switching pins 12, 11, 10, or 9 of the 82S126. The output is combined with the clock signal in the remaining NAND of 4011 and available as a tone at the 10k pot. The output is adjusted to provide drive as needed.

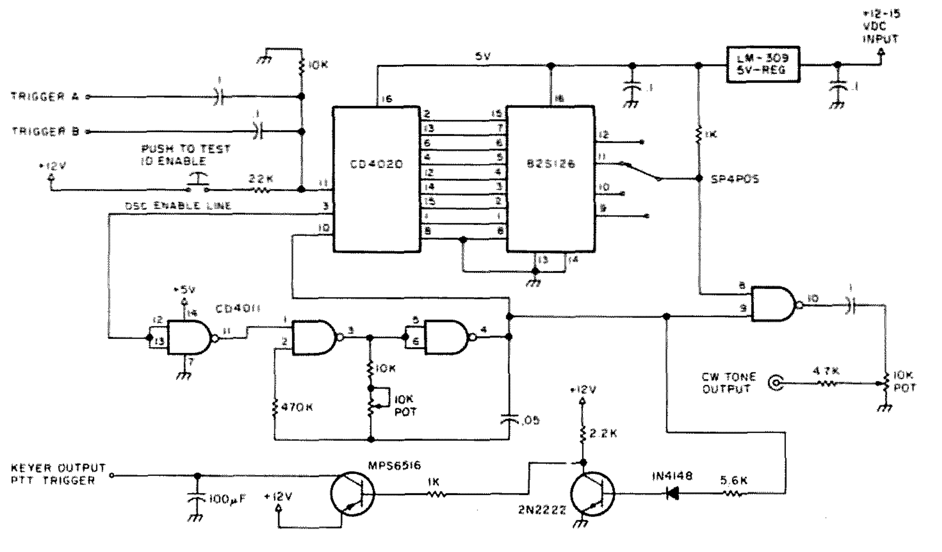

Fig. 3. Schematic of CW IDer. Any IDer can be used with the basic system shown in Fig. 2.

Burning the messages into the PROM is not particularly easy unless you are equipped to do it properly. If you don't have a PROM programmer, it is best to buy a chip and have the supplier burn the memory. Any IDer will work with the Porta-Peater (i.e., diode matrix, or other PROM/ROM types) as long as an audio output signal and an external trigger input line are available. The original model used a VHF Engineering kit. Alternatively, you can build the system without any IDer at all and use voice ID.

The circuit as designed uses an isolated single-pole relay for switching. Depending on your radio, you may have to use an SPDT relay for electronics-switched radios to move 12 volts from the RX to TX enable lines. For relay-switched rigs, simply use the SPST to complete the relay circuit in your radio.

Construction

The latest version of the Porta-Peater is mounted on two printed circuit boards, a mother and a daughter board. The mother board is shown in Photo F. Most of our units used a hand-wired panel instead of a daughter board. The mother board contains all of the command, control, and ID functions. All signal I/O, ground, and power buses are brought out to a standard 0.156-inch, 22-pin edge card connector. The daughter board interfaces to the mother board via the connector, or you can handwire the two boards together.

The daughter board has the TX LED, audio input jack, PTT output jack, local mike jack, ID-message-select switch, and ID-test switch mounted on it. This approach makes for a design that can be put in various enclosures easily without rewiring. Photo F shows how jumper wires were used instead of a daughter board.

The selection of enclosure is a matter of personal choice. The only requirement is that it be reasonably rf tight. The last thing you need is rf floating around inside an audio-frequency-control system.

Cable Assembly

Two interface cables are required to use the system. One is a shielded audio line and the other is a four-conductor microphone push-to-talk line. Since normally you will use the Porta-Peater physically close to the two rigs forming the repeater pair, a short convenient length is all that is needed. Two-foot lengths are a good starting point.

Most newer transceivers use subminiature jacks for external speakers. The jack

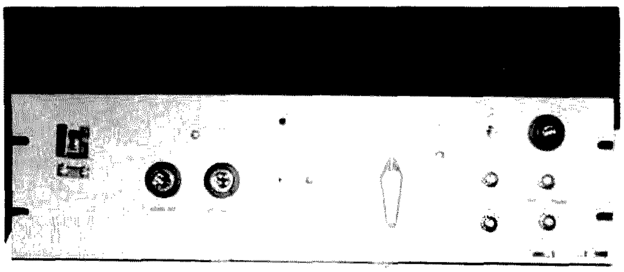

Photo E. Rack-mount version of the Porta-Peater.

Symptom	Possible Cause	Fix
1. Erratic time out	1. Leaky tantalum	1. C7
2. Erratic ID timer	2. Leaky tantalum	2. C17
3. Erratic VOX or distorted audio	3. LM3900—low gain at Vcc	3. LM3900, or remove protective input diode to raise Vcc by 0.8 V
4. No ID	4a. No clock	4a. 4011
	4b. No count	4b. 4020
	4c. No data	4c. 82S126
	4d. No audio	4d. 4011
	4e. No trigger	4e. 2N2222, MPS6516
5. Erratic ID	5. Poor voltage Regulation	5. LM309K

Fig. 4. A troubleshooting chart of symptoms, causes, and possible fixes.

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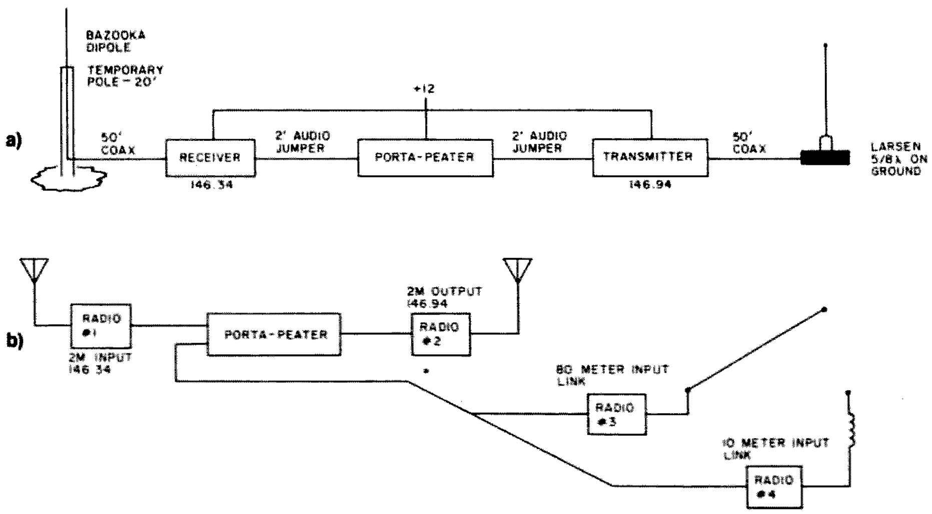


Fig. 5. Layout (a) shows a typical 2m hookup, and (b) a 3-band input command center. All inputs show up on 146.94 out. Mode has no effect on the system (i.e., CW, SSB, FM).

on the audio input of the Porta-Peater is also subminiature. Therefore, make up or buy a shielded jumper with subminiature connectors at both ends. In order to cover more possibilities, you might want to purchase several connector converters to change the subminiatures to PL-55 or whatever you have. Remember, the cable must be shielded.

The Porta-Peater uses a standard 4-pin, screw-on microphone plug. Again, most new rigs use this type, also. It is important that you make up this cable with the proper pin assignments. If you know in advance with which rigs you most likely will be using the Porta-Peater, you can make up a couple of dedicated jumpers. Alternatively, a small minibox can be made with a terminal block inside and the proper jumper assignments made for the rig to be used. Fig. 6 shows a possible design. This approach permits fast and easy field changes. Again, use only shielded cable.

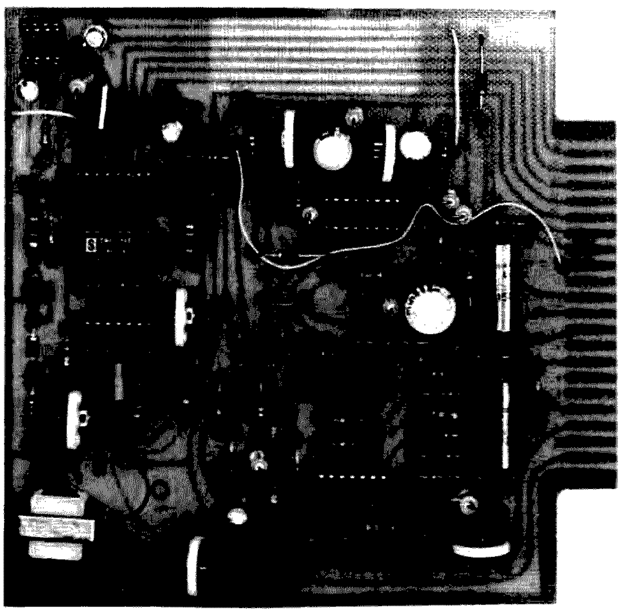


Photo F. Populated printed circuit board with externally mounted IDer on right side. Final version was all on one board.

Circuit Assembly

Figs. 2 and 3 show the entire circuit for Porta-Peater III. PCB construction is recommended but not required. (A commercially-manufactured PCB is available for purchase; write WA2BHB or AC2A for information.) Any type of perfboard assembly is fine. Layout is not critical except for isolating the inputs and outputs of the high-gain LM3900. Parts substitutions can be made except for the low-leakage tantalum capacitors. These must be used where specified because otherwise the circuit performance will be degraded or it will not work at all.

Alignment and Adjustment

The adjustments of the audio gains on the Porta-Peater are set to the particular rigs it is connected to. Simply hook up two rigs as per the schematic in Figs. 1, 2, and 3. Apply power and adjust for best audio. Select your ID message, push to test, and you are finished. If things don't seem all peaches and cream, perform troubleshooting procedures.

Troubleshooting

If your unit does not function, use the fail/cure list in Fig. 4 and you should be able to home in on the problem in a few minutes. (This list assumes that you have previously looked for broken connections and bad solder joints and taken corrective action.) Before taking apart your unit, be sure you have checked and tried the full range of adjustments on all the pots for gain, output, and oscillation on the Porta-Peater.

Field Hookup

In a field installation, all that is needed is two rigs and a 12-volt source to set up a Porta-Peater repeater. Remember, you can configure any setup you wish by proper interconnection of the audio output and microphone PTT lines to the rigs in use. The Porta-Peater gives you the capability to set up a reasonably sophisticated communications network based simply on whatever random collection of amateur rigs happens to be available in any emergency situation. Fig. 5 shows some configuration possibilities.

For a typical 2-meter QRP repeater setup, follow these instructions:

1) Select the rig to act as a receiver.

2) Set the desired input frequency on this unit.

3) Run a jumper from the external-speaker jack of the receiver rig to the audio-input jack of the Porta-Peater.

4) Connect the PTT-microphone-output jack of the Porta-Peater to the microphone-input jack of the rig selected as the transmitter. Make sure all ground audio and switching lines are wired correctly; otherwise the system will not work or could damage the

units. Set up the transmitter frequency.

5) Apply +12 volts to all units.

6) Set the receiver squelch to the desired trigger level.

7) Adjust the receiver volume control (when receiving a signal) to a level which doesn't overdrive the Porta-Peater and distort the transmitter signal (a quick on-the-air check is best; monitor with an HT).

8) Turn the volume on the transmitter rig to low or off (volume, not power).

9) Locate antennas for minimum interference and overload. (See Antenna Setup Hints.)

10) Operate and enjoy!

Antenna Setup Hints

If you want frequency agility and you are not using a duplexer, all of your isolation comes from antenna separation. Our standard setup uses two 50-foot lengths of RG-8 coax and a pair of 10-foot poles. One pole is aluminum, the other is bamboo. The two poles are lashed together, with the bamboo on top. A vertical dipole is made from the RG-8 by turning down the braid 19 inches leaving the insulated center conductor as is. This forms a bazooka dipole for one antenna; the Larsen 5/8 wavelength is used for the other. A 1/4 wavelength can be used, but in either case, ground-level mounting is employed.

In our field trials, it did not seem to matter which antenna was used for receiving or transmitting. You probably will want to try the different combinations for yourself in case there is some incremental improvement for a particular location. Under any circumstances, the two antennas should be separated as far as possible or until desensitization ceases. I often bring up the Porta-Peater before laying out the antennas, then, while the rig is madly squealing, walk the ground-level antenna away until the squealing stops.

In severe space-limitation situations, we sometimes put an attenuator in the receiver transmission line and eliminate desensitization by lessening receiver sensitivity. It is very easy to get radio coverage of a hamfest (i.e., several acres) when a 10- to 20-dB pad is ahead of the receiver.

Operating Notes

One of the things discovered in using the Porta-Peater with various 2m rigs was how really poor many amateur and commercial transceivers are in terms of their rf tightness. Several instances occurred where we thought the Porta-Peater was not performing right and was causing problems but found out that it was a manufactured rig which was at fault. Microphones with unshielded cables, no 12-volt lead rf bypassing, and plastic cabinets or face plates all contributed to problems. In a high-density rf environment (like the Dayton Hamvention), a rig which is not truly rf tight will give a lousy performance.

Therefore, if the Porta-Peater exhibits problems which could be contributed to rf leakage, check the rigs you are using first. A tight enclosure, with shielded and bypassed leads, will make a world of difference.

Pocket Porta-Peater?

The development and construction of this unit was really a challenge for us. Generally, it was fun (although WA2BHB seems to have less hair now than at the beginning of this project!). However, since the Porta-Peater was designed, Icom has, of course, come out with its new IC-2A synthesized HT. So, if we had a miniaturized Porta-Peater and two IC-2As, we literally could have a pocket-sized repeater that was no less frequency agile!

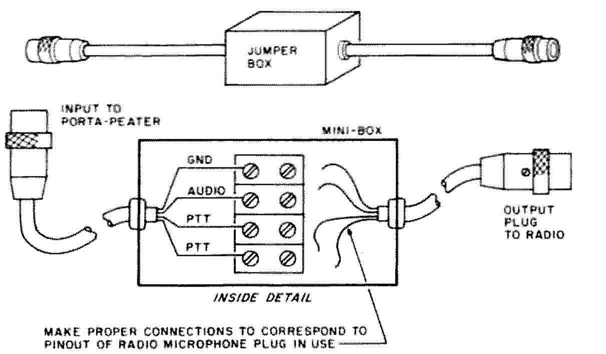
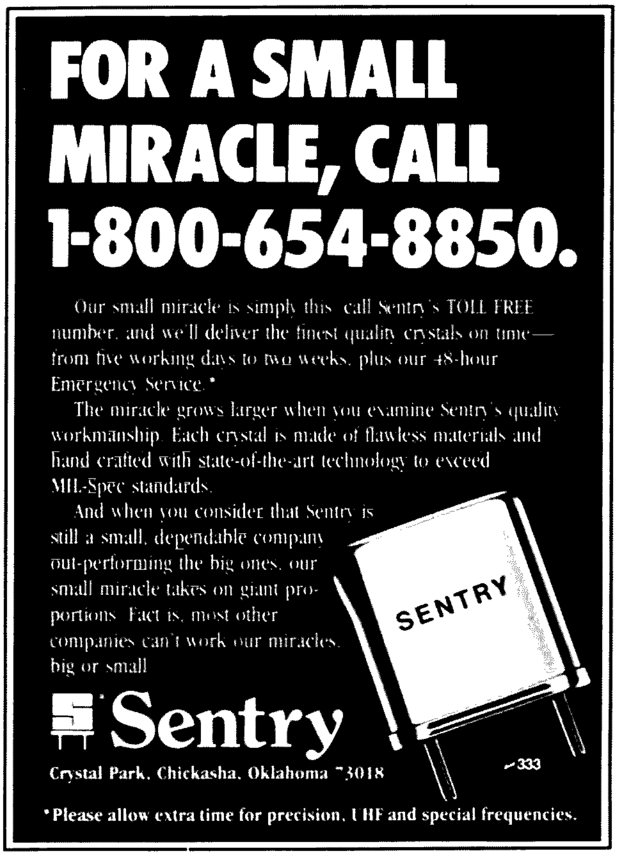


Fig. 6. A jumper box will solve the problem of a fistful of audio cables. Use shielded box and cables only.

Well, the Pocket Porta-Peater is in development. It uses a lower current drain IDer, advanced IC VOX system, is smaller in size, but it does cost more (unfortunately, some smaller parts cost more than their bigger brethren). However, if you don't need to carry a repeater in your pocket, the present version represents the best bet.

Follow-Up

I will gladly answer any questions on the Porta-Peater, but you must include an SASE if you expect a response. Please remember, I'm a ham, not an electronics engineer, so the quality of answers must be gauged accordingly. 73s, and I hope you have as much fun with your Porta-Peater as we have had with ours. ■



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Amateur Television's Stripper

—a home-brew star

(Ed. Note: For further information about this article, readers should consult the "Corrections" section of this issue.)

Of the many different ways in which radio amateurs participate in our wonderful hobby, amateur television is probably one of the least understood by the general ham population and virtually unheard of by the general public. I am not referring to slow-scan TV, but to old-fashioned, regular fast-scan television.

Since I was actively involved in TV broadcasting about twenty years ago, in the days of black and white, I knew of the limitations involved. We used to pump out 16 kW of visual rf and about 10 kW aural and were happy to be informed that some viewers 40 miles away could still actually see us, which was not always the case. You can see that I was always very skeptical of the concept of amateur television. What was the point of proving that we could squirt a live picture a few blocks away? Big deal, right?

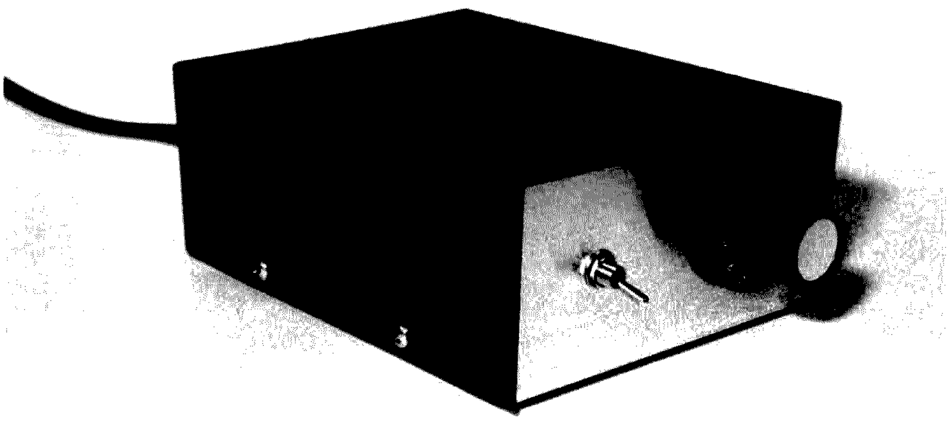

Photo A. The completed ATV converter.

Now I am here to tell you that I, and anyone thinking along the same lines, could not be farther from the truth. About five years ago, one of our local club members found out that I was trying to build my own TV camera and talked me into experimenting with some simple ATV equipment. After puttering around for a few weeks and optimizing a 6-element yagi, commercial TV converter, and a ½-Watt, 6J6-type free-running modulated oscillator, we actually managed to work over a path of thirteen miles. We were so enthusiastic that we wrote articles to several club bulletin editors to mark this great local breakthrough. There was no turning back now. I proceeded to push ATV from then on by demonstrating at ham

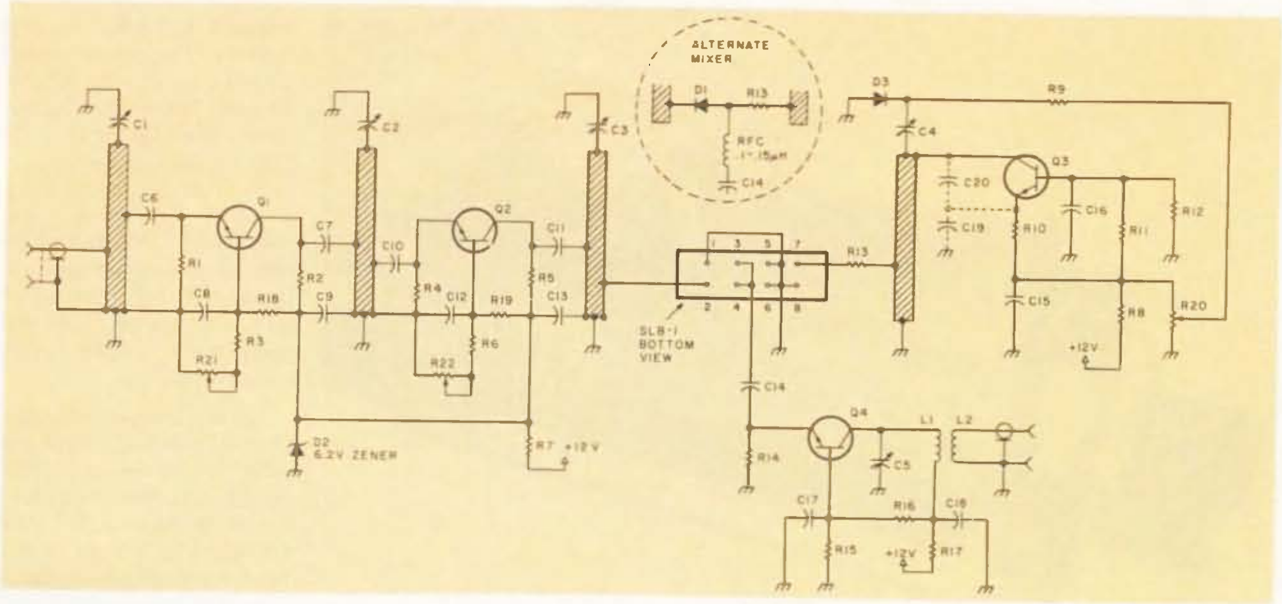

Fig. 1. ATV converter schematic.

clubs, hamfests, shopping malls, etc., and lecturing others on the pros and cons of ATV.

I have learned a great deal since that early beginning and, so, would like to pass on some helpful information to other hams who might want to follow in my footsteps.

First of all, ATV is not for everybody. I have seen many people come and go over the years. If you are not really that much interested in the workings of radio, from a scientific point of view, then forget it. Even if you buy all your equipment ready-made and get involved with your local ATV gang, you would soon lose interest because all they ever talk about and show you are ATV parts, circuits, theory, etc., until it comes out of your ears.

There are times when no one will be on, and that's usually when you want to demonstrate to your friends that you own channel 13½ and can do the same as your local station, only better. Other times, you may want to tune up your new preamp and find no one on; it can be frustrating. But there are times when another ATVer calls you on the land-line (or on 2 meters) and tells you that the band (70 cm) is wide open because the UHF TV stations are coming in like gangbusters. You will then drop whatever you are doing and get on the air right away, only to find out that all hell has broken loose on ATV—everybody and his brother seem to be coming in on a night like that.

You find yourself looking at a lot of co-channel interference, sometimes three stations at once. You turn your beam like crazy trying to separate them, while everybody is asking you via 2 meters to switch your transmitter on as well. You go bananas trying to videotape and play back, make pictures with your Polaroid, and keep track with your log sheets while simultaneously panning cameras, showing logos, etc. These openings occur more frequently than one might expect, depending a lot on your geographical location.

Around the Great Lakes region, we have a lot of thermal inversions. During the warmer weather from early spring to late fall, I can work W3POS in Erie PA at least a few times a week, and we are 85 miles apart.

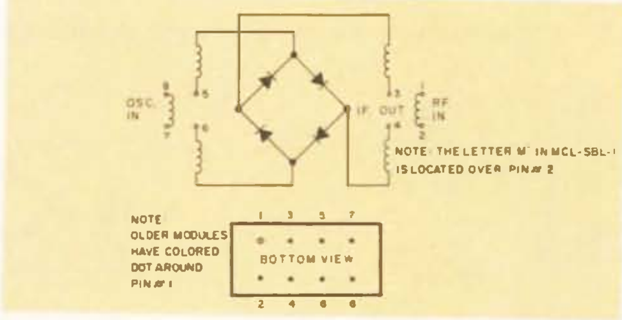

Fig. 2. Double-balanced mixer hookup details.

Last year, I worked W9ZIH in Chicago IL, which is 420 miles away from me. I also have seen K9KLM and N9AB who are up to 440 miles away from me. (See December, 1979, *73 Magazine* Letters, p. 226, or November, 1979, *A5 Magazine* for more details.)

With my present setup, I can work stations within a 50-mile radius quite comfortably. I put out 50 Watts of rf on 439.25 MHz, with sound on the video carrier, into a compact skeleton-slot antenna. (See March, 1969, *CQ Magazine* for more details.) I usually can see a 10-Watt station quite well, providing he uses a good antenna system and is not located at the bottom of a pit.

In an attempt to see how low we could go, VE3QF in

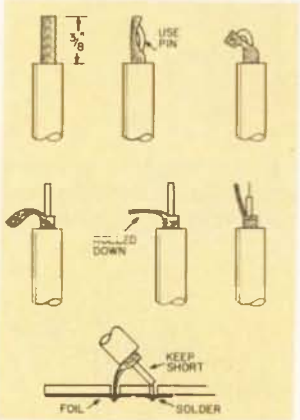

Fig. 3. RG-174 coax preparation and installation.

Toronto, Ontario, reduced his power to 50 mW into a set of four 27-element yagis and his picture frame would still lock in at my TV set. The picture quality was P½ (P5 being absolutely snow free) and we were 50

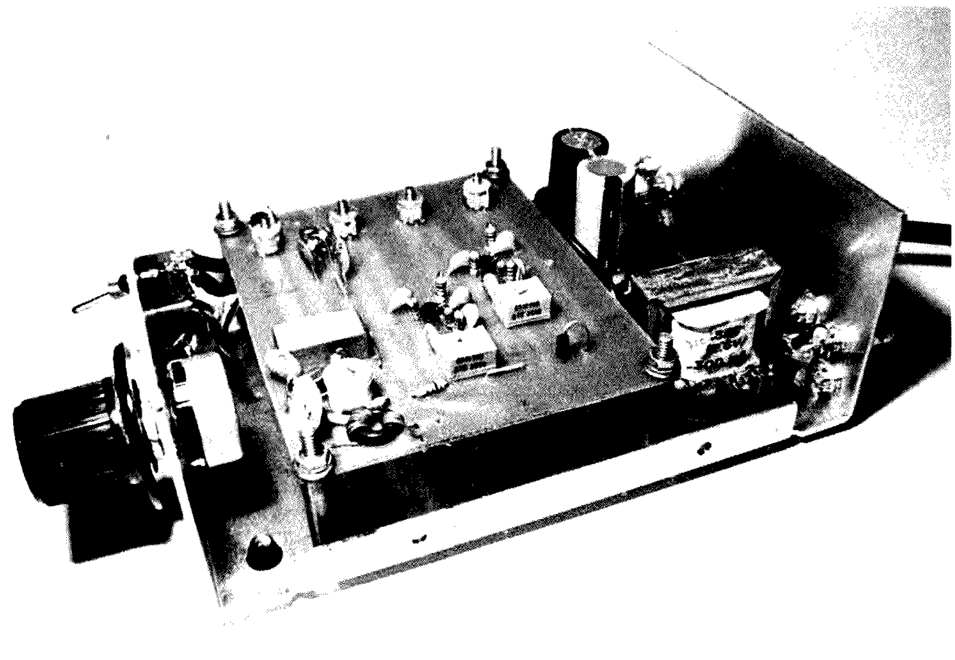

Photo B. Inside view of the converter showing PCB mounted on standoffs.

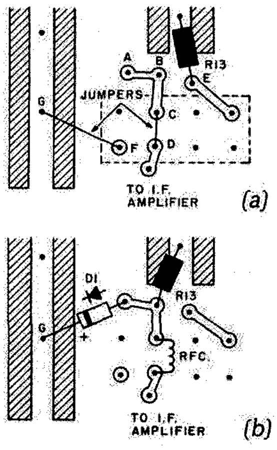

Fig. 4. Mixer installation details. (a) Double-balanced mixer. (b) UHF diode mixer.

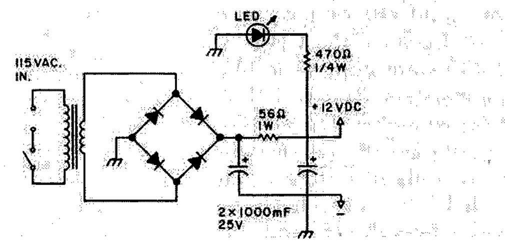

Fig. 6. 12-volt power supply.

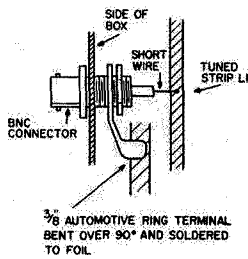

Fig. 5. BNC connector mounting.

miles apart. So, you see, with the converters, preamps, and antennas we use nowadays, ATV is really worthwhile. After all, a picture is worth *more* than a thousand words.

You, too, can do it, for it doesn't have to cost you an arm and a leg. If you are a newcomer to this TV game, make sure that there is local interest; find at least one other ATV fanatic. You will need at least one other person that you can count on for testing, adjusting, and fiddling with your video and audio equipment—it takes two to tango. Just two stations can keep busy for days, pruning and tuning. And when you drop that sharply-tuned converter, everything is out of whack again and you are set for another night of fiddling. When you've got a whole group on, you can take turns hamming it up making "Pink Rose Tea" commercials, putting on wigs or crazy caps with badges, and showing all your empty 807s.

As with any other mode of communication, the first thing to do is to be able to receive well enough. No point in playing around with old-fashioned UHF television converters, unless you are prepared to hang two or three preamps in cascade between it and the antenna. You can waste a lot of time this way and finally give up in disgust. If you can get ahold of a varactor UH tuner from a late-model TV set, you might be better off, although you still need additional amplification. Some of them will tune right down to 439.25 MHz and lower.

Unfortunately, the output frequency will only correspond with your TV set's video i-f frequency, which means you have to modify. Besides that, you do not take advantage of your TV UHF tuner's gain and selectivity. You also could build an ATV converter from various kits that are advertised in some ham publications, but my experience tells me that you will still need more amplification and selectivity.

Among the best preamps that I have built over the years were the ones that used tuned lines. The problem with them is that they are a bit tricky to make. You've got to be a combination of plumber and sheet-metal worker and you'll still end up with an amateuristic-looking contraption.

A couple of years ago (during a quiet ATV night), an idea came to me. Why couldn't I use stripline techniques instead of gas pipes and sheet copper? After all, they use it on rf power amplifiers for VHF and UHF. I decided to take one of my pet construction articles (see 1971 ARRL *Radio Amateur's Handbook*, page 417), of a 432-MHz preamp, and convert the tuned-line dimensions to stripline. I ended up with a printed circuit board that was a two-dimensional copy of the original three-dimensional preamp.

After I completed the new preamp, it took me a while to get things stabilized, but I got it working—surprisingly well, I might say. As a matter of fact, the results were so impressive that I supplied a number of ATVers in the area with similar preamps. I've made a few more since then, each time changing the dimensions a little bit; the objective was to make it smaller and simpler. Eventually it evolved into a complete converter.

The converter (Fig. 1) which will be described in

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this article is actually the seventh in the series, each one being an improved version of the former one. This one consists of two stages of rf amplification, one varactor-tuned oscillator, and one i-f amplifier. Also incorporated is a double-balanced mixer (more about this later!)

If you are not in the market for a complete converter, you might be interested in just copying the rf sections. Or, you might like to use the i-f (channel) amplifier separately between your own converter and boob tube for another 6 dB of gain. You also could use the oscillator as a self-contained unit to be used as an independent UHF signal source.

I will now describe each section individually so that you can take out whatever section you might be interested in. Later on in this article we will put it all together and make a complete, tunable, high-gain ATV converter.

The Rf Section

As I said earlier in this article, you can find the theory on this two-stage preamp in the 1971 and older *Handbooks*. Although we now use stripline, it seems to work basically the same way. In some earlier attempts, I used feedthrough capacitors and even used separators between stages, as well as carefully-selected bias resistors. Even though I had the thing working, I didn't want to press my luck at that stage and try anything more radically different than what I had already done with the tuned-line (tubing)-to-stripline conversion. In more advanced models, we got rid of the feedthroughs (too expensive) and separators and even tried a whole range of replacement transistors. We finally settled on what we've got now, it seems to be the best, cheapest, and easiest way to go.

The rf amplifiers could be used as a one- or two-stage preamp. Both PCB layouts are provided so that you can take your pick. The one-stage job was carefully evaluated by Ralph W2RPO, using professional equipment. The test results indicated a 15.3-dB gain at 440 MHz, with a bandwidth of roughly 20 MHz between 3-dB points. Noise figure was not measured but is assumed to be close to the 1.7-dB mark, as the manufacturer of the MRF901 states. Even with the best modern TV UHF converters, a one-stage preamp like this one should make quite an improvement, at least another P unit, as we ATVers call it—maybe even two P units.

The two-stage preamp

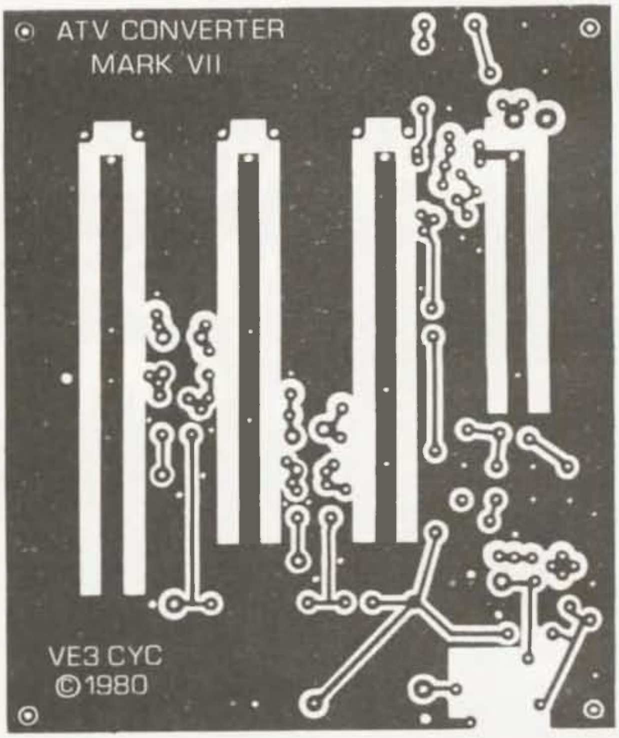

Fig. 7. ATV converter PCB layout.

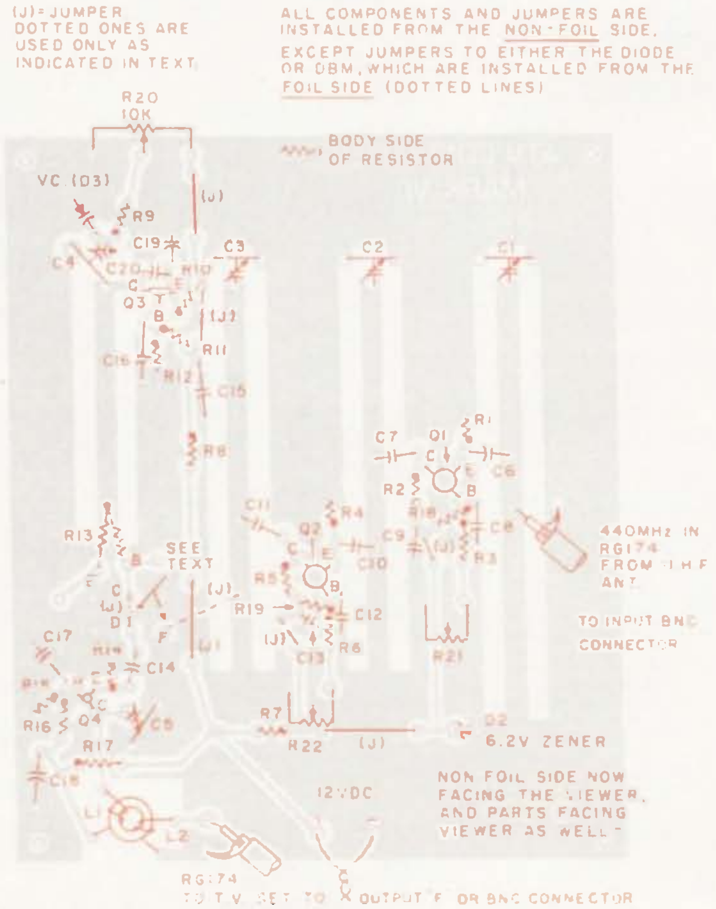

Fig. 8. ATV converter component location.

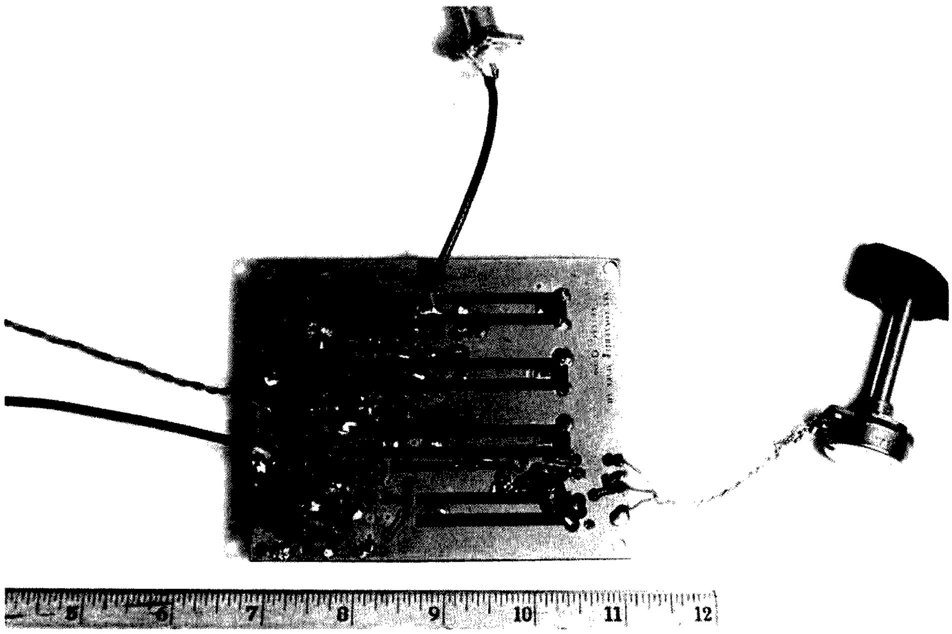

Photo C. *Foil side view of converter with input, output, power, and frequency control connections.*

will give about 40 to 50% more gain over the one-stage preamp. Therefore, you will have to decide whether it is worth the effort—it will make a day vs. night difference on those old tube-type converters like they used to have years ago—I can vouch for that.

I have dropped the 12 V down to about 6.2 V, which improves stability and keeps the noise figure down. You might try a higher voltage for more gain if you wish by changing the zener and dropping resistor values, but it will be trickier to tune up, especially when you live in intermod alley.

The Oscillator

It is not easy to make an oscillator work well with direct output in the 70-cm band. I had tried several schemes until I found this one. It originally had been developed by Tom O'Hara W6ORG, and it's used extensively in Tom's own products (PC Electronics). I have received Tom's permission to use his oscillator in this article.

Besides the change to stripline, I also changed a few values of parts, mainly to be more adaptable to other transistors (he uses the MPSH81) but also to keep the whole thing from radiating too much and getting into my scanner, etc. The two silver-mica capacitors, C19 and C20, are not always necessary with some transistors; the Sylvania ECG106 does a good job without them. These capacitors will lower the tuned frequency, and as a rule, the higher the value, the easier the oscillator starts and the less it drifts (try to keep the ratio about 1:3). If you've ever worked with regenerative UHF receivers, you might recognize the principles of this oscillator.

To preset the oscillator, it is best to set the 10k frequency control at mid range, clip a lead from a frequency counter to the output end of the 47-Ohm resistor (R13) and ground, and tune trimmer C4 to read 372 MHz for a 439.25-MHz video frequency in your area, providing your TV channel input would be channel 4. If you choose channel 3, your oscillator should be set at 378 MHz, and for channel 5 it should be 362 MHz, etc.

The carrier frequencies of channels 2, 3, 4, 5, and 6 are 55.25, 61.25, 67.25, 77.25, and 83.25 MHz, respectively. The sum of your chosen channel frequency and the oscillator frequency should be 439.25 MHz in this case, and correspondingly different for other ATV frequencies. If you don't have a frequency counter, you could use your TV set tuned to channel 59 or 60 and look for the second harmonic. The 1k resistor (R8) might have to be lowered if the oscillator fails to start.

I have tried several types of low-power PNP silicon UHF transistors, and most of them oscillate readily in this circuit. However, some have a tendency to drift more than others. The drift is not objectionable though, as it has to drift at least a few MHz to affect the video, which is seldom the case.

The I-f Amplifier

The main reason for the amplifier was to overcome the conversion losses in the double-balanced or the diode mixers, which is about 6 to 7 dB. The T37-2 toroid seems to be a better match than a T37-10 or T37-12 which I also have tried. The tuning is smoother and the tendency to oscillate has disappeared. The wire size is not critical; I have used #24 to #30 wire with equal results.

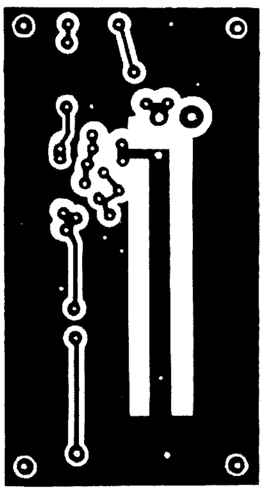

Fig. 9. UHF oscillator board PCB layout.

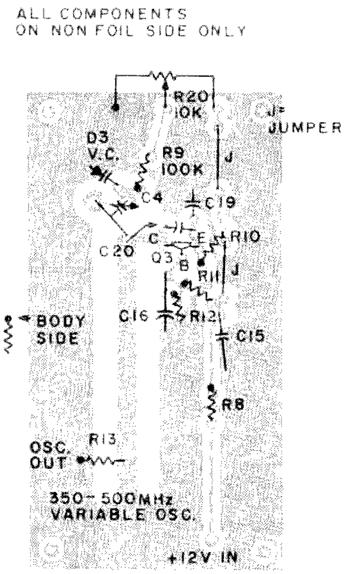

Fig. 10. UHF oscillator board component location.

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This amplifier can be tuned up by hooking it to your TV set's unbalanced input (75-Ohm). On some older sets, you might have to go past the balun directly to the VHF tuner input. Apply power, clip a piece of wire to C14, and tune for the best picture on the channel of your choice or the next one, if the channel is blank. That completes the tuning.

The Mixer

When I started writing this article, the only mixer worth considering, in my opinion, was a double-balanced mixer (see *The Radio Amateur's Handbook* for details). The one I selected was the MCL-SBL-1 (see Fig. 2) for no other reason than availability. There is no question about it. They do a fine job in this circuit. But in small quantities they are rather expensive.

So, just for you cheapskates out there like myself, I included a makeshift mixer, which consists of two parts: a home-wound rf choke and a small-signal diode. How cheap can you get?

Despite its simplicity, this cheap mixer works very well. The conversion losses seem at least equal to if not less than the double-balanced mixer, but it is slightly more prone to intermod (at least when you live within a mile of FM and TV stations as I do). Nevertheless, it is a good substitute until you can get a double-balanced mixer—or you could use it permanently.

Construction and Tune-Up

The printed circuit boards are made of single-sided G10, 1 oz. copper-clad laminate. After you have obtained your board, either through your own efforts or otherwise, it is best to make sure that all parts have the proper hole sizes (i.e., #62—resistors and capacitors; #60—MRF901 transistors; #56—trimmer capacitors; 1/16"—coax braiding, etc.).

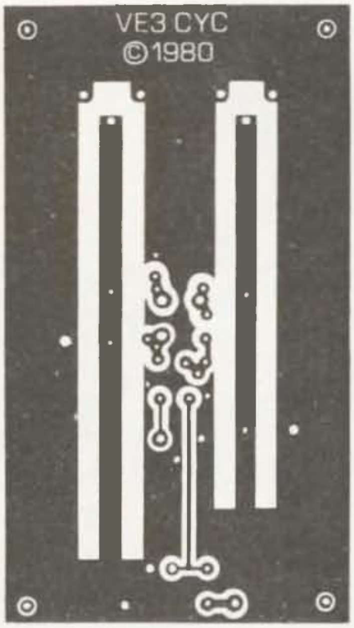

Fig. 11. One-stage preamp board PCB layout.

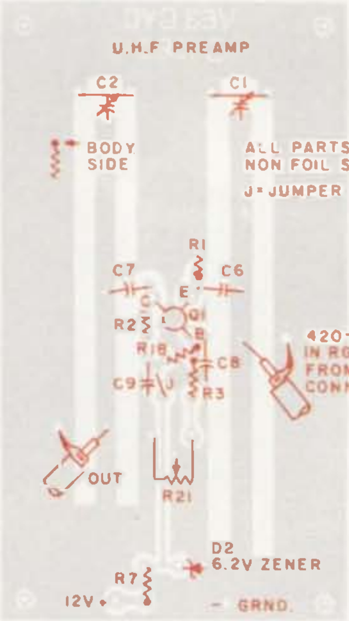

Fig. 12. One-stage preamp board component location.

Place all trimmer capacitors and trimmer resistors in their respective positions. Some of these parts might not line up right away; you might have to bend the pins to fit them. These parts must be flush with the board before soldering.

Next, I would suggest that you install all the jumper wires. (Refer to the component location figures for positioning of all parts and jumpers.) Install all capacitors, chipping off excess material around the leads as may be required to place them flush with the board. Then install the resistors, leaving the 12-V side of R7 and R8 detached. Make sure that these are flush as well, as shown in the photos. Always install them with their bodies

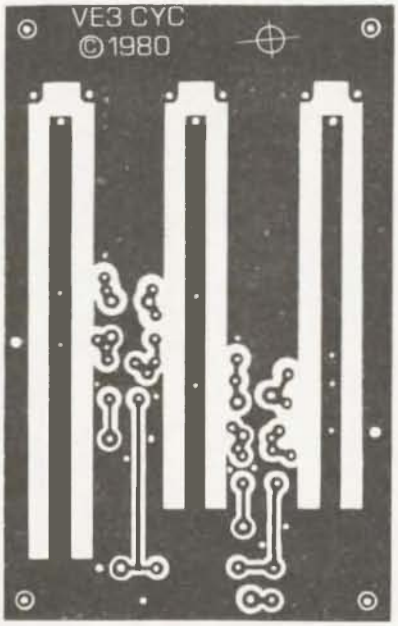

Fig. 13. Two-stage preamp board PCB layout.

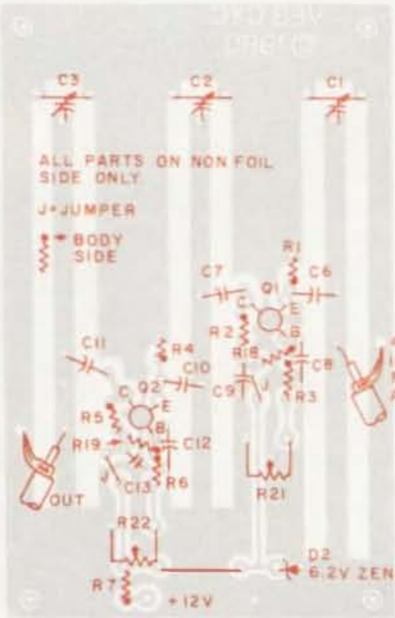

Fig. 14. Two-stage preamp board component location.

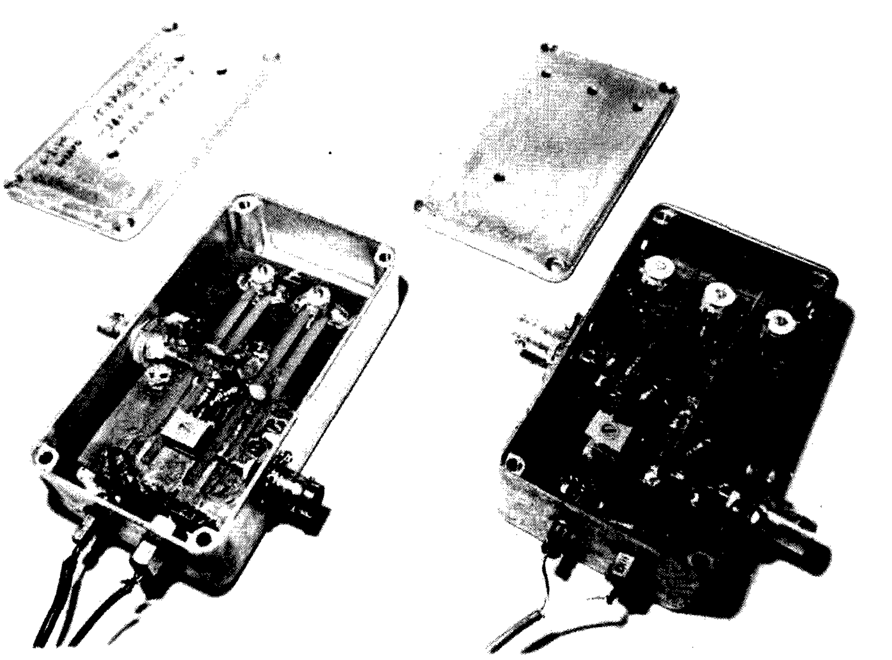

Photo D. Completed preamps in metal enclosures.

toward the rf side and leads toward the ground side.

Now install the transistors and diodes. Observe proper pin connections on the transistors and polarity on the diodes. Use a small soldering iron on this job and don't apply too much heat, as the copper foil may come loose. Never use a soldering gun on this kind of work—it might kill your transistors.

Install the remaining parts (toroid coil, rf choke, double-balanced mixer), then the power leads, three wires to the tuning potentiometer, R20, and the input and output cables from the board to the connectors. Make sure that the inner leads of each RG-174 cable to the board are as short as physically possible. A neat way would be to fish the inner lead with a pointed object through the side of the braided shield. About 3/8" from the end, roll the braided material to a smaller size between your finger tips, and solder in the ground hole as indicated in Fig. 3.

Normally, I would have included a couple of 1N914s back-to-back across the input for protection, but I skipped the idea, since it would just give you a false sense of security. Besides losing a little gain, I found it to be very ineffective when it comes to rf overload protection.

I have blown away a small fortune on replacement transistors in the process, despite the presence of the diodes. They even blew without any battery power hooked up every time I switched my 100-W linear on.

After throwing away my home-brew antenna relay (made from a conventional relay) and replacing it with a proper coaxial relay, my problems were solved. At this frequency, you only need a few pFs of stray capacitance between the relay parts to pass enough energy to knock that front-end transistor from here to the moon and further while the diodes just sit there laughin' at you. It doesn't seem to bother them.

Depending on whether you go for the double-balanced mixer (DBM) or the diode mixer, you will have to make some minor changes accordingly. Referring to Fig. 4(a), if you use the DBM, you will have to join C and D, hook R13 to E, and join G to F with a jumper wire as shown. Referring to Fig. 4(b), when using the diode mixer, join G and A with the mixer diode, D1, keeping the positive (banded) side on G, and hook R13 to B—that's all. *Make sure* to install the DBM from the component side of the board, and solder all 8 pins to the appropriate traces and ground connections. Note: To prevent C14 from accidentally shorting against the DBM, it might help to keep some clearance between the mixer module and the circuit board (about 1/16" will do).

I have used several types of diodes (silicon and germanium) and most of them seem to work quite well. A 1N82 UHF diode I tried seems to be a good choice. Hot-carrier diodes were disappointing in this circuit. You might try different ones yourself as most small-signal diodes work well in the GHz range.

In regard to the independent preamp boards (one or two stage), they should be installed in a metal box of some kind. I have used die-cast aluminum boxes for this purpose. The boards should be mounted away from the walls of the box as near to the center as possible by using spacers. If the box is small enough, you could possibly solder it right onto the BNC connectors as I did (see Fig. 5 and Photo D). Use a 0.001-μF feedthrough capacitor to feed 12 V in.

Preamp or Converter Alignment Procedure

While I explained the alignment of the oscillator and i-f amplifier earlier in this article, I will now proceed with explaining how to align the preamps and also the complete converter assembly:

1) Connect output to TV set, tune in your favorite i-f channel, and clip a length of wire to C14. Apply 12 V (Fig. 6, for example) to supply line and tune C5 for maximum on TV set.

2) Set R21, R22, C1, C2, and C3 to mid-range.

3) Tune TV to a low UHF channel that has a program on. Connect UHF TV antenna input to C10, R4, or Q2's input by spot-soldering a wire onto one of these spots. Connect a UHF antenna to antenna input on preamp or converter board. Hook a 12-V supply to R7 and ground.

4) Peak up C1, C2, and slowly turn R21 counterclockwise until a point of maximum gain is reached. If R21 is turned too far, the stage will break into oscillation; it should be kept just below this point.

5) Disconnect wire as installed in step 3, hook UHF TV's antenna to output of 2nd rf amplifier (connecting point to either D1 or SBL1, whichever is applicable), and peak up in the following order: C3, C1, C2, R22, and R21.

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6) Repeat step 5 a few times until everything tunes smoothly. Be careful to keep R21 and R22 below the oscillating points. By now, you should notice quite an increase in gain on the UHF channel.

7) Tune oscillator as described under "The Oscillator" by applying 12 V to R8.

8) Solder R7 and R8 to 12-V line.

9) Peak up complete converter once more, step-by-step, to a distant ATV signal source.

10) After you close up your box or whatever metal housing you decide to use, you will have to touch up the adjustment a little to allow for detuning caused by the metal shield. If your box is the kind with slots in it, you could reach some trimmers with a narrow tuning tool, and after turning the shield half a turn, do the same with the remaining trimmers. In other cases you might accomplish this feat by using a temporary cover made from a tin can with some holes punched in it.

By now you should be able to pick up ATV stations 40 to 50 miles away, and hand out P4 picture reports, while others wonder how you do it; they only get a P2 picture or nothing at all. If you've got money to burn, you might want to use a $20 transistor in the front end with a 0.9-dB noise figure, but I wonder if you'll notice much difference.

Some Afterthoughts

If you run out of range on the 5k trimpots (R21 and R22), you could extend them by using higher values for R3 and R6. This might be necessary with some oddball transistors but if you stick with the types I mentioned, you should have no problems. If R3 and R6 prove to be too high, you can lower their values, but don't go below 220 Ohms. You won't have enough isolation between the trimpots and the rf-carrying parts of the transistor bases.

If you are interested in a wider range of coverage such as 427-444 MHz, it would be better to stagger-tune the stages a bit—439 MHz on the first rf stage and 434 MHz on the second stage for instance; this also will improve stability.

If you pick up signals that shouldn't be there while your box is closed, you might have to resort to a bandpass filter; there are some good designs in the *Handbook*, etc. I am working on one now that uses stripline techniques similar to the ones in this article. If successful, you might see it some day.

In regard to the varactor diode tuning arrangement, some suitable diodes can be found in surplus varactor TV tuners. Varactor diodes do not change capacitance in a linear response to a varying voltage, so don't expect your tuning arc to be linear with the oscillator frequency. The arrangement used here seems adequate, but you could alter the value of the tuning potentiometer, R20, and add series resistance to make the dial more linear. This, of course, will change with the kind of diode used. For instance, when R20 is 3k instead of 10k and you put a 6.8k resistor in series with the pot's ground leg and ground, your dial will cover about 6 MHz over its total arc (see Fig. 3).

You could make up a second board just for the oscillator to be used as signal sources. By carefully tuning, I managed to go as high as 500 MHz and as low as 350 MHz. When tuned to 439.25 MHz, it acts as a fairly stable low-power signal source ideal for tuning up UHF preamps.

My future plans include the development of a similar setup as described in this article, but for higher frequencies such as 900 and 1296 MHz. I am also presently working on a UHF TV exciter, intermediate amplifier, and linear amplifier, all solid state and stripline, of course!

I must thank the many Canadian and American ATVers who switched on their TV transmitters endlessly for long periods of time (which is hard on the tubes and transistors with small heat sinks and no blowers) just for me to tune up and try a newly-made preamp. And for their encouragement for me to write this article. Special thanks in this regard go to: VE3EJV, VE3CJP, VE3EYR, W3POS, W2RPO, and W2PBU.■

Parts List for Converter and Preamp Boards:

C1-4—.6-to-5.5-pF film trimmers (Phillips 010EA 5E) note #1
C5—22-pF film trimmer (Phillips 010EA 20E)
C6-14—0.001-μF ceramic disc capacitors, 1/4" lead spacing
C15-18—0.01-μF ceramic disc capacitors, 5/16" lead spacing
C19—5-pF silver mica (NPO) 3/16" lead spacing or axial leads, see note #2
C20—1.5-pF silver mica (NPO) 3/16" lead spacing or axial leads, see note #2
R1-8—1.k-Ohm, 1/4 W
R9—100k, 1/4 W
R10—470 Ohm, 1/4 W
R11—27k, 1/4 W
R12—10k, 1/4 W
R13—47 Ohm, 1/4 W
R14—330 Ohm, 1/4 W
R15,16—2.2k, 1/4 W
R17—100 Ohm 1/4 W
R18,19—4.7k, 1/4 W
R20—10k volume control (linear) Radio Shack #271-1715 or equivalent
R21,22—5k trimpots, Jim Pak #850P5K (Radio Shack #271-335, 10k, as a possible substitute only; requires one additional hole in board)
D1**—1N82 or equivalent high-speed, low-power UHF diode, or better
D2—6.2-V 1 W zener diode (1N4735), Radio Shack #276-561
D3—Varicap diode ±15 pF at 4 V (MV2205, MV2105, CGE-95, or equivalent
Q1,2—MRF901 transistors or equivalent NPN silicon UHF types
Q3—MPSH81, ECG106 or equivalent PNP silicon UHF types
Q4—2N2222
Rfc—approximately 0.1 to 0.15 μH (Cambion #2960-21-03-00) or wind your own: 10 turns #28 close-wound on 1/8" form or 1/2 W 100k resistor
Mixer*—Double-balanced mixer MCL-SBL-1 (made by Mini Circuits Lab, 2625 E. 14th. St., Brooklyn NY 11235; see '78 *Handbook*, page 306 for equivalents)
L1—5 turns of small gauge hook-up wire or #24 enamel wire on Amidon toroid T37-2
L2—3 turns same as L1
Miscellaneous parts: RG-174 coax cable, two BNC connectors, SPST mini toggle switch, LED, knob, hardware to mount board, and cabinet
*Only needed when not using diode mixer
**Only needed when not using double-balanced mixer (SBL-1)
Note #1: Transcap #24PX005 from Mouser Electronics could be used instead although you have to re-drill some holes. Similarly, Transcap #24PX020 could be substituted for C5.
Note #2: Plastic-film-type capacitors or even ceramics (NPO types) could be used as substitutes for the more costly silver mica types. Lower values such as 1 pF and 3 pF have also been used successfully.
All circuit boards, parts, built-up boards, and complete units are available from Spectrum Electronics. For price list and ordering information, write to PO Box 4166 Station D, Hamilton, Ontario, Canada L8V 4L5.

Reader Service for facing page ✓331→

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Batavia IL 60510

Polishing Kenwood's R-1000

—a gem in the rough

This is not intended to be a product-report type of article. There are a few improvements that can be made to the R-1000 with a little effort and some are mentioned in the advertising literature. I will say that I think the R-1000 is an outstanding receiver that has excellent stability, sensitivity, and ease of operation. Following are some comments on the suggested changes.

The R-1000 comes supplied with three i-f filters: 12 kHz, 6 kHz, and 2.7 kHz. The advertising literature mentions that the filters can be switched to use the 6 kHz for AM WIDE and the 2.7-kHz filter for AM NARROW. This is not difficult, as the filters are diode-switched and there are no critical circuits involved. Actually, all filters can be used, as will be shown.

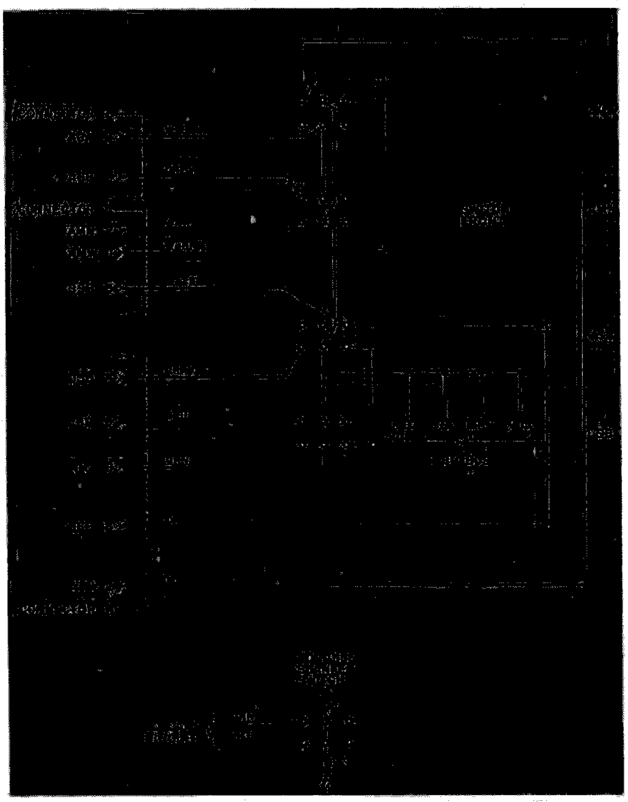

Fig. 1. Original mode switching for the R-1000. Switch at bottom is BRIGHT/DIM display control.

Kenwood goofed on the agc time-constant switching. In fact, both the schematic supplied with the receiver as well as the one in the service manual fail to show the agc switching as it is actually wired. The problem is that the fast agc is used in the SSB mode and the slow agc is used in the AM mode, just the reverse of the way it should be. Further thinking resulted in wanting the agc switched separately from the mode. It is sometimes desirable to switch to fast agc when using an SSB receiver for RTTY.

When using the R-1000 below 2 MHz, I encountered a lot of broadcast signals where they didn't belong. This is due to the fact that a single bandpass filter is used ahead of the rf amplifier for the 200-kHz-to-1-MHz range, and a second one is used for the 1-to-2-MHz range. This allows both harmonics as well as intermod products to be present. Also, while the 1000-Ohm input is probably better for the random-type wire antenna most likely to be used when tuning this range, it is probably still quite far from what the antenna impedance really is. Now for what to do about these items:

Fig. 1 shows the actual wiring of the switches as traced in my receiver. In the AM mode, 9 volts is switched to the appropriate i-f filter switching diode to activate the appropriate filter. In the SSB mode, the 2.7-kHz filter is turned on via SSB gate diodes, D51,52. The AM detector is selected by the normally-closed contacts on the SSB switches. When either AM switch is depressed, AGA and AGB are connected together, resulting in the longer time constant.

Fig. 2 shows some additional circuitry found in the service manual that did not appear in the schematic supplied with the receiver. In the AMW mode, Q47 is turned on, which grounds the negative end of C158. This extends the low-frequency response for hi-fi quality. (It is possible that the earlier R-1000s did not have this circuit, explaining why it was not in the man-

ual. If this is the case, the pin numbers shown for connector 4 may not be as shown in my drawings, but the wire colors are probably the same.)

Some comment on the display is due at this point. I feel that the bright display is too bright. Also, the display and lamps are bound to last longer if operated in the dim mode, especially if you leave the time displayed when not using the receiver. Thus, I decided to use the BRIGHT-DIM switch to switch the agc time constant.

Removing the lamp wires from the switch and taping them up leaves the display in the dim mode. (By the way, you will have to remove the front panel to make the wiring changes. This is done by removing both the top and bottom sections of the receiver case. Then remove the knobs. The bandswitch and tone knobs have hex screws; the others pull off. Remove the two screws holding the analog frequency dial knob. Then the panel screws can be removed. The mode switch is held on the front panel with two screws.)

Fig. 3 shows the change in the switch wiring I made in my R-1000. Rewiring the switches as shown not only allows use of the 2.7-kHz filter on AM, but also allows use of all three filters in both modes. This is possible due to the mechanical construction of the 4-section mode switch. It is possible to release all the buttons by pressing one in only as far as necessary to release one that is latched. It is also possible to have more than one depressed at a time. With all switches released, the receiver is in AM with the 2.7-kHz filter selected. (The 2.7-kHz filter is now switched directly with 9 volts instead of via the SSB gate diodes.) AMW and AMN are the same as before. When either USB or LSB is depressed, both AM switches are released, resulting in the 2.7-kHz filter being selected. If you desire wider bandwidth in SSB, press either LSB or USB and at the same time press AMN for 6 kHz or AMW for 12 kHz. Pressing another button will release both latched switches.

The AGA and AGB leads are wired to the normally-open contacts of the dimmer switch. Now, fast agc occurs with the switch released and slow when the switch is depressed. The strap across the common terminals is left alone. The red and black wires that go to the center switch terminals are removed and soldered together so the red lead going to the noise blanker switch is still grounded.

It occurred to me that with the 12-kHz filter in the receiver, an FM detector could be added for those who want to listen to the FM activity on the high end of 10 meters. A simple 565 PLL circuit can be added to provide this; however, it would be necessary to add a switch somewhere and also dig into the main circuit board itself to switch the audio.

For those wanting a little better selectivity for RTTY, it is possible to obtain a 1.5-kHz filter from Murata. It will be necessary to remove the main receiver board to change filters (probably best to change the 12-kHz one).

Low-frequency performance of the R-1000 can be improved with an outboard tuner. The tuner can be used with a whip, wire, or coaxially-fed antenna. It will perform impedance transformation from 50 Ohms to 1000 Ohms. A whip or short wire (most any ham antenna used as a single wire looks short at these frequencies) looks like a capacitive load. This type of antenna is best connected right to the "high" end of the tuned circuit. Fig. 4 shows a suggested tuner.

While my tuner includes several coils for three frequency ranges, I only show one here. You may wish to use ferrite rods or slug-tuned coils, but the link-winding turns should remain about the same. If your antenna has a high capacity to ground, the high frequency end will not extend as far as you may wish. This may be cured by adding about 100 to 200 pF in series with the wire antenna input on the higher frequency range. Some values are shown in Table 1.

Going down in frequency, the sensitivity rapidly drops off below 200 kHz. (The specs say 200 kHz is the bottom end of the useful range.) Above this frequency the sensitivity runs

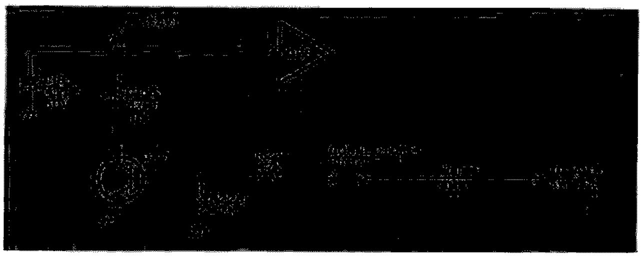

Fig. 2. Additional circuit on Q28 shown in service manual. This extends low-frequency response on AM wide.

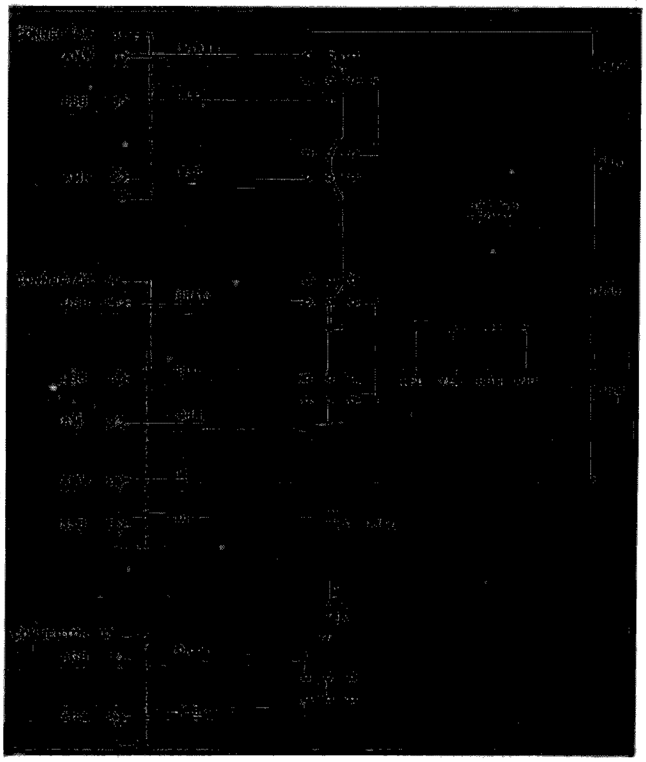

Fig. 3. Modified mode switching to provide fast and slow agc.

Frequency Range	L1	L2 (turns)	Tap (turns)
1-2 MHz	40 µH	20	5
0.5-1 MHz	150 µH	20	5
200-500 kHz	1 mH	30	6
80-200 kHz	6 mH	40	8

Table 1. Approximate values for R-1000 antenna tuner.

1900 - 2500 MHZ KITS

DOWN CONVERTER KIT $19.95

1 P.C. BOARD PRE-DRILLED AND SOLDER FLOWED
3 MRF901 TRANS.
2 HP DIODES
6 CHIP CAPS "LARGE"
8 RESISTORS
4 PREPAIRED COILS, FACTORY WOUND
1 10 MFD CAP.

ANTENNA KIT $19.95

33 WASHERS
32 SPACERS
1 3 FOOT ROD
2 NUTS
1 8" PVC PIPE
2 4" END CAPS
1 MOUNTING BAR
1 "F" CORNECTOR
1 NUT AND DOLT

POWER SUPPLY KIT $19.95

1 P.C. BOARD
1 POWER TRANSF.
1 317L ADJUSTABLE REGULATOR
1 FINE TUNING POT. WITH SWITCH
1 COARSE TUNING POT.
2 KNODS
3 "F" CORNECTURS
4 POWER DIODES
1 RF CHOKE
3 RESISTORS
3 DISK CAPS.
1 1000 MFD CAP.
1 DPDT MINI TOGGLE SWITCH
1 LED WITH HOLDER

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about 1.2 μV. At 150 kHz, sensitivity is down 16 dB, and at 100 kHz it is down 37 dB.

Being a low-frequency addict, I wondered if the low-frequency range could be extended. I felt that the filter consisting of L1, L2, L3, C7, and C8 was the limiting area. Connecting the signal generator to the junction of L4 and C9 confirmed this. It looked worthwhile to bypass the filter components, and this can be done without removing the circuit board if you are careful.

Cut the anode lead of D1 close to the board. Then cut the lead of C8 that connects to L3. Cut this lead close to the body of the capacitor. Strap the anode of D1 to this wire that went to the capacitor. Now the sensitivity is 2 μV at 150 kHz and 3 μV at 100 kHz. At 50 kHz, the sensitivity is 20 μV, where it originally was 18000 μV! This modification does not seem to increase the broadcast interference noticeably. In either case, an external tuner is needed if you are near any broadcast stations.

Kenwood sells a kit for operating the R-1000 on 12 volts dc. Why this is not included in the receiver is anybody's guess, but this feature can be easily added. There is no reason that a connector is needed on the power supply board. A pair of wires for the +12 and ground connections can just be soldered directly to the board. The power supply board is easily removed by unsoldering the wires from the power transformer. There is a blank plate on the rear panel of the receiver where the dc power connector is intended to go. A connector of your choice can be installed here. I recommend fusing the dc input with a 1-Amp, slow-blow fuse.

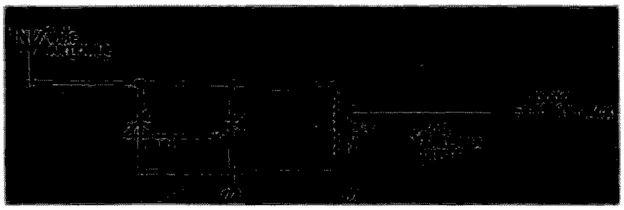

Fig. 4. Antenna tuner for the R-1000 (2 MHz and lower). C1 is a dual broadcast variable, about 730 pF.

The receiver cannot be powered by nicad batteries for very long as the current is typically around 700 mA. It draws 25 mA with the receiver off. Having the display on DIM reduces the drain by about 20 mA. Looking at the voltage readings on the drawing reveals that the audio output stage draws about 140 mA. It is evident that this stage (Q28) is inefficient because the heat sink runs quite warm.

I don't believe that there is a better device that is pin-for-pin compatible, but it still may be worth investigating replacing Q28 with something else. Also, if extended battery operation is anticipated, it might be smart to switch the displays with a momentary pushbutton switch. I estimate the displays draw 60 to 100 mA.

I did a quick check on the audio-frequency response (in the SSB mode) to see how bad it might be for RTTY. It is desirable, of course, to have a flat response at the mark and space frequencies. I originally thought that the bfo frequencies could be changed to favor RTTY operation so I did adjust the trimmers to move the bfo frequencies further from 455 kHz. They wound up at a maximum of 1700 Hz above and below 455 kHz. With the bfo readjusted like this, the response, relative to 2125 Hz, is −0.5 dB at 2295 Hz, −1 dB at 1550 Hz, and −1.5 dB at 2975 Hz. I consider this pretty good. The high-frequency response is better at the speaker output than at the record output, which was a surprise.

I hope I have not painted a dim picture of the R-1000. I think a lot of thought was put into the design. An engineer who designs equipment for the military told me that the basic rf design (synthesizer and upconverter front end with a high-frequency i-f) is the way most of the new precision communication receivers are designed. It is a fine choice for hams and SWLs alike. ■

Author's Note

Between the time I originally submitted this article and when I received the proof copy, more experiments were done on the R-1000 receiver. There have been a lot of complaints about the agc time constant being too long. I agree and therefore changed mine so the time constant compares with that of the 820 transceiver. To decrease the "fast" agc time constant, remove capacitor C217. To decrease the "slow" agc time constant, either replace C138 with a 1.5-uF capacitor or install a 2-uF capacitor in series with the AGA or AGB lead at the switch. Note that the present C138 is polarized, so if you use a polarized capacitor, connect it correctly.

To improve the high frequency response in the SSB mode for better RTTY characteristics, change C159 from .047 uF to .015 uF. This will not noticeably change anything by ear, but will produce mark and space tones of equal amplitude.

R-1000 receivers with serial numbers 009001 or higher have a jumper plug which will permit use of the 2.7- or 6-kHz filters in the AM mode. If you want to be able to use any of the three filters in either SSB or AM mode, my previous switch wiring modifications still apply.

Thanks to Ken WB9FRV for suggestions and help with the additional changes.

Reader Service for facing page ✓15→

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Peaking and Tweaking Surplus CB Boards

—the untold story

The closing of Hy-Gain's electronic assembly operations in early 1978 created a stock of readily-available surplus parts for the amateur who was willing to convert a CB printed-circuit-board assembly to 10-meter operation. These were PLL-type boards which require only two or three crystals for frequency generation. Several articles have appeared during the ensuing time describing the methods to use in converting to 10 meters. The most common method is simple crystal replacement, although some authors have opted for vco retuning.

The purpose of this article is to supplement this information with details which will describe the various boards used, and to provide correct alignment procedures.

There were five different models of board assemblies using PLL circuitry which may have made their way into the surplus market. Four of these were manufactured in Japan and have these identifying part numbers: PTBMO27AOX, PTBMO36AOX, PTBMO38COX, and PTBMO51AOX etched into the foil of the board. The fifth, manufactured by Hy-Gain itself, has the number 750096 etched in the foil and the Hy-Gain name silk-screened on the component side. This board, while very similar to the circuit used in the Japanese boards, was destined for use in the manual-switched radios and the remote-controlled model 2716 microprocessor radio; it contains mostly US transistors and ICs.

The Japanese-manufactured boards were used in model series 680, 2680, and 2700, along with some of the base stations. Table 1 gives component types, symbolism, and oscillator frequencies for boards which were used in these series.

For those who have converted factory-assembled transceivers, there may be an X or an A following the model number on the serial plate. These were identifications used to indicate various levels of FCC type acceptance, and don't have any bearing on amateur work. There may be various component differences which were required to meet tightened FCC emission requirements, but for the most part they have no effect upon the ultimate function of the unit.

Table 2 gives the same information for the remaining models of the 2700 series, and Table 3 covers the 750096 Hy-Gain-designed board.

Alignment instructions for each series will be listed separately due to changes in component identification and function. There is, however, little variation from one board to another. As in all alignment procedures, there is interaction between successive sections, so go back and forth for maximum performance. The most critical alignment in the transmitter section concerns the three final coils. Follow directions carefully, and a power output holding within ± 0.5 W can be obtained over the 40-channel spread permitted by the PLL.

There can be significant differences, from one board to another, in maximum power output—which is a function of the final amplifier transistor. Ranges will be between 3.5 W and 7.0 W. Component designations are silk-screened on the component side of the board.

Since several methods of conversion have been used, the alignment instructions are written for the original frequencies. If you have converted the board already, the relationship between the original frequencies and the converted frequencies will be obvious.
Note: Most of the components in the vco circuit have been covered with hot-melt wax to prevent movement. This should not be disturbed as component placement is critical to maintaining performance of the circuit.

Transmitter Alignment PTBMO27AOX

This board uses a three-crystal scheme. Q105 is a 9.51-MHz oscillator, Q109 is the 5.9453-MHz offset oscillator, and Q117 is a 6.4005-MHz reference oscillator.
Step 1—Oscillator Frequency Check

Q105 collector should show 9.5 MHz. Change values of C118 (nominal 47 pF) and C119 (nominal 10 pF) to correct frequency. Q109 collector should show 5.9435 MHz. Change value of C130 (82 pF) to correct frequency. Q117 should indicate 6.4005 MHz, and

C178 (39 pF) can be changed if necessary.

Step 2—Vco Alignment

Place the channel-selector switch in position 1. Using a high-impedance VOM connected between TP8 (R114) and ground, adjust T101 for 1.5 volts. Change channel switch to position 40 and the voltage should read 4.0 volts.

Step 3—Pre-Adjustment

Using a wattmeter or swr meter showing relative power output and a dummy load, turn L110 clockwise until it reaches bottom (don't over do it!). Turn L106 clockwise until power output is about 2 Watts.

Step 4—Rf Alignment

Set the channel-selector switch to position 1. Tune (in order) L103, L104, T102, and T103 for maximum rf power output. Turn L106 further clockwise if necessary to keep power at about 2 W. Change the channel-selector switch to position 40—power output should be within 0.25 W of position 1. Repeat the above procedure until this condition is met. This tuning sequence is shaping the bandpass of the rf circuit, which is capable of almost flat response across the channels if properly tuned.

Step 5—Final Circuit Adjustment

This is the most critical step in obtaining maximum power output and in maintaining the flat power response across the channels. With the channel switch in position 1, adjust L109 for maximum output, and then L110 for maximum. Repeat the adjustments. Switch to position 40 and verify that power output remains within 0.5 W. If not, L109 often has two positions for resonance, and normally the lower position is correct. Find the second position and repeat the adjustments of both coils. If this has no effect, turn L110 clockwise one-half turn and repeak the final circuit by readjustment of L109. Repeat as necessary.

Lastly, adjust L106 for maximum output. Repeak L109, and then L110 slightly, as required. Check channel 40 for power output within the 0.5-W specification.

Step 6—Modulation Adjustment

Using a scope or other modulation indicator connected to the antenna terminal (dummy load still attached), adjust RV102 for correct modulation. If a calibrated, modulated signal generator is available, put 20 mV at about 1 kHz into the mike input and adjust for slightly under 100% modulation.

Step 7—Rf/S-Meter Adjustment

The board was fabricated for use with an rf/S-meter. A suitable meter can be connected between point 6B and ground. Adjust RV104 (20k pot) to calibrate meter to the power output indicated on the wattmeter.

Receiver Alignment

This board has circuitry for anl functions which can be made operational by connecting point 39 on the PCB to ground. Do this prior to receiver alignment.

Step 1—Vco Alignment

The vco circuitry is common to both transmit and receive functions of the transceiver, and was covered in the oscillator-frequency check in the transmitter-alignment section.

Component and Designation	Function
Q101	vco
MPS3704	
Q102	PLL mixer
2SC710D	
2SC829	
2SC839	
Q103	Buffer
2SC710	
2SC829	
2SC839	
Q104	Buffer
2SC710D	
2SC829	
2SC839	
Q105	Oscillator*
2SC710D	
2SC829	
2SC839	
Q106	AVR (Automatic
2SC1318Q	Voltage Regulator)
Q107	Xmit switch
2SA719Q	
Q108	Buffer
2SC1359B	
2SC1047	
Q109	Offset oscillator*
2SC710D	
Q110	Xmit mixer
2SC710D	
MPS3704	
Q111	Pre-driver
2SC1215	
2SC1687	
2SC1688	
Q112	Driver
2SC1760-3	
2SC1957	
Q113	Rf power amp
2SC1306	
2SC1678	
2SC1816	
Q114	Rf amp
2SC784	
2SC1047B	
2SC1359	
Q115	1st mixer
2SC710B	
2SC1359B	
Q116	2nd mixer
2SC710	
2SC829C	
2SC839	
Q117	Ref oscillator*
2SC710D	
Q118	1st i-f
2SC710	
2SC829C	
2SC839	
Q119	2nd i-f
2SC710	
2SC829C	
2SC839	
Q120	Squelch
2SC327Y	switch
2SC828	
2SC945	
Q121	Range boost
2SC372	
2SC828PQ	
2SC945	
Q122	Xmit audio
2SC372	alc
2SC828PQ	
2SC945	
Q125 (36AOX only)	Noise blanker
2SC900U	gate
Q126 (36AOX only)	Noise blanker
2SC900U	amp
IC101	PLL custom chip
IC102	Audio amp
TA7205P	
BA521	

* Values:

	27AOX	36AOX, 38COX
Q105	9.51 MHz	11.8066 MHz
Q109	5.945 MHz	10.695 MHz
Q117	6.4 MHz	10.24 MHz
IC101	01A	01A

Table 1. Components and functions for the 27AOX, 36AOX, and 38COX.

Step 2—Circuit Alignment

Use the rf/S-meter previously installed, an audio VOM connected to the speaker terminals, or a scope to monitor alignment. Set a frequency generator, or a very attenuated transmitter, to a mid-frequency (27.205 MHz if still unconverted) and very low output to avoid agc action. Adjust, in order, L115, T104, T105, L112, T106, T107, T108, and T109 for maximum output. The frequency generator should have low-level modulation if using audio output as the indicator. Since adjustments interact, repeat several times to obtain maximum sensitivity. If using a calibrated generator, check sensitivity at each band edge. Sensitivity should be less than 1 uV.

Step 3—Squelch Circuit Adjustment

Turn to maximum the external pot being used for squelch control and adjust RV101 so that an S9 signal just breaks the squelch. If you are using a calibrated generator, input a 50-uV signal at the antenna terminal and adjust for squelch break.

Step 4—S-Meter Adjustment

Using the same signal level as step 3, adjust meter-calibration pot RV103 for S9 indication.

This completes the alignment for the PTBMO-27AOX board.

Transmitter Alignment
PTBMO36AOX and PTBMO38COX

Step 1—Oscillator-Frequency Check

These boards use a three-crystal frequency scheme. Q105 is an 11.8066-MHz oscillator, and C118 (39 pF) and C119 (12 pF) may be changed to adjust frequency. Offset oscillator Q109 operates at 10.695 MHz, and C127 (56 pF) is used for frequency adjustment. Q117 is the 10.24-MHz reference oscillator, and C178 (56 pF) is used to adjust frequency.

Step 2—Vco Adjustment

Connect a VOM to TP8 (R114) and adjust T101 for 1.5 V with the channel-selector switch in position 1. Switch to position 40, and the voltage should be 4.5 V.

Step 3—Pre-Adjustment

Using a wattmeter or swr meter showing relative power output and a dummy load, turn L110 clockwise until it reaches bottom. Turn L106 clockwise until power output is about 2 W.

Step 4—Rf Alignment

Set the channel-selector switch to position 1. Tune (in order T111, L103, L104, T102, and T103, for maximum output. Turn L106 further clockwise if necessary to keep power at about 2 Watts. Change the channel switch to position 40—the power output should be within 0.25 W of position 1. Repeat the above procedure until this condition is met. This process is shaping the bandpass of the rf circuit, and it is capable of almost flat response across the channels.

Step 5—Final Circuit Adjustment

Use the same procedure as in Step 5 for the 27AOX board.

Step 6—Modulation Adjustment

Use the same procedure as in Step 6 for the 27AOX board.

Step 7—Rf/S-Meter Adjustment

Use the same connection and adjustment procedures as on the 27AOX board.

Receiver Alignment

The boards were designed with an anl function which can be made operational by connecting point 29 on the PCB to ground; this should be done prior to receiver alignment.

Step 1—Vco Alignment

The vco circuit is common to both transmit and receive functions of the transceiver, and was covered in the oscillator-frequency check in the transmitter-alignment section.

Step 2—Circuit Alignment

Use the rf/S-meter, an audio VOM connected to the speaker terminals, or a scope to monitor alignment. Set a frequency generator, or a very attenuated transceiver, to a mid-frequency and very low output to avoid agc action. Adjust, in order, T104, T105, L112, T106, T108, and T109 for maximum output. The frequency generator should have low-level modulation if using audio output as the indicator. Since adjustments interact, repeat several times to obtain maximum sensitivity, decreasing the generator output if necessary. If a generator is used, check the sensitivity at both band ends, which should be less than 1 uV.

Step 3—Squelch Adjustment

Use the same procedure as with the 27AOX board.

Step 4—S-Meter Adjustment

Using the same signal level as in step 3, adjust meter-calibration pot RV103 for S9 indication.

This completes alignment of the 36AOX and 38AOX boards.

Transmitter Alignment
PTBMO51AOX

Step 1—Oscillator-Frequency Check

This board uses a two-crystal frequency scheme in conjunction with the particular PLL circuitry used in the design. Q1 is a 10.2-MHz reference oscillator for the PLL and injects a signal into the second receiver mixer, Q10. This signal is fed into PLL IC1 where it is divided by 1024. A 10.695-MHz signal is generated and mixed with the above in IC3.

Q1 should show a frequency of 10.24 MHz. Adjust TC1 (adjacent to X1) for correct frequency. The mixer oscillator (10.24 MHz) as measured at pin 1 of IC3 can be adjusted by changing the value of C25 (4 pF).

Step 2—Vco Adjustment

Connect a VOM to TP8 and adjust L1 to obtain 1.5 V with the channel switch in position 1. Switch to position 40, and the voltage should be 3.6 V.

Step 3—Pre-Adjustment

Using a wattmeter or swr meter showing relative power and a dummy load, turn L12 clockwise until it reaches bottom. Turn L7 clockwise until power output is about 2 W.

Step 4—Rf Alignment

Set the channel-selector switch to position 1. Tune (in order) T1, L2, T2, L5, T3, and T4 for maximum power output. Turn L7 further clockwise if necessary to keep power at or about 2 W. Change the switch to position 40, and power output should remain constant within about 0.25 W. Repeat the above procedures until this condition is met. This procedure is shaping the bandpass of the rf circuit, and it is capable of almost flat response across the band.

Step 5—Final Circuit Adjustment

This is the most critical adjustment to obtain maximum power output and maintain the flat power response across the band. With the selector switch in position 20, adjust L11 for maximum power output and then L12 for a higher maximum. Repeat the adjustments. Switch successively to channel 1 and 40 to verify that power output remains within 0.5 W of that obtained in position 20. If it does not, return to position 20, turn L12 a quarter turn clockwise, readjust L11 for maximum output and recheck position 1 and 40. Last, adjust L7 for maximum output. Repeak L11

and L12 slightly for maximum output. Recheck channels 1 and 40.

Step 6—Modulation Adjustment

Using a scope connected to the antenna terminal (dummy load still attached) or other modulation indicator, adjust RV2 for just under 100% modulation. If a calibrated, modulated signal generator is available, put 20 mV at about 1 kHz into the mic input and adjust for the correct modulation level.

Step 7—Rf/S-Meter

The board was fabricated for use with an rf/S-meter. A suitable meter can be connected between point 68 and ground. Adjust RV2 (near L12) to calibrate the meter to the power level indicated on the wattmeter.

Receiver Alignment

This board has circuitry for an anl and noise-blanker function. The anl can be made operational by connecting points 31 and 41 on the PCB. When these points are not connected, the noise-blanker circuit is operational. A switch can be installed for easy function selection, and the anl should be engaged prior to alignment.

Step 1—Circuit Alignment

Use the rf/S-meter, an audio VOM connected to the speaker terminals, or a scope to monitor alignment. Set a frequency generator or a *very* attenuated transmitter to a mid-frequency and very low output to avoid agc action. Adjust, in order, T5, T6, L14, T7, T8, and T10 for maximum output. The frequency generator should have low-level modulation if using audio output as the indicator. Since adjustments interact, repeat several times to obtain maximum sensitivity and, if using a calibrated generator, check the sensitivity at each band edge. Sensitivity should be less than 1 uV.

Component and Designation	Function
Q1	10.24-MHz oscillator
2SC710	
Q2	Buffer
2SC710	
Q3	Rf pre-driver
2SC1687	
Q4	Rf driver
2SC1750	
2SC1846	
2SC2036	
Q5	Rf power amp
2SC1306	
2SC1678	
2SC1974	
2SC2075	
Q6	AVR (Automatic
2SC1318	Voltage Regulator)
Q7	Xmit switch
2SA719	
2SA720	
Q8	Rf amp
2SC710	
2SC460	
2SC1047	
Q9	1st mixer
2SC710	
2SC1359	
Q10	2nd mixer
2SC710	
2SC829	
2SC839	
Q11	1st i-f
2SC710	
2SC829	
Q12	2nd i-f
2SC710	
2SC829	
Q13	Audio switch
2SC372	
2SC828	
2SC945	
Q14	ALC
2SA564	
2SA719	
2SA720	
Q15	ALC
2SC900	
2SC945	
Q22	Dc switch
2SC900	
IC1	Custom PLL 02
IC2	Vco/mixer/buffer
TA7310P	
IC3	Xmit osc/mixer
TA7310P	
IC4	Audio amp
BA521	

Table 2. Components and functions for the 51AOX.

Step 2—Squelch Circuit Adjustment

Turn the external pot being used for squelch control to maximum and adjust RV1 (adjacent to T8) so that an S9 signal just breaks the squelch. If a calibrated generator is being used, input a 50-uV signal at the antenna terminal and adjust for squelch break.

Step 3—S-Meter Adjustment

Using the same signal level as Step 2, adjust meter-calibration pot RV3 (adjacent to T10) for S9 indication.

This completes alignment of the 51AOX board.

This board was made to use an LED channel display. A special channel-selector switch with an extra section of contacts protruding from the top side was mounted to the board. Another PCB assembly (PTSWO23AOX) was connected to the top of the switch and contained the LED drivers. The LEDs were mounted on board assembly PTLDO15AOX and interconnected to the driver board with flat ribbon cable. Each board connected to the identical lettered holes on the other board. Driver board PTSWO23AOX hole 1 is connected to main PCB ground and hole 2 to terminal 9 on the main PCB.

Hy-Gain produced two radios that had all of the functional controls in the microphone, the main chassis assemblies of which could be mounted in the trunk or under the car seat. This not only facilitated ease of operation but, by removing the microphone, prevented theft.

Model 2679

The transceiver used conventional PLL circuitry contained on the 36AOX board which was connected to an auxiliary control board mounted above it on the metal chassis. The control board has 750070 etched on the foil side, and 878928 silk-screened on the component side. The rear of the chassis contains a large 16-contact connector which was used to interconnect with the microphone through a specially-made cord.

The microphone was black with two seven-segment red LEDs used for channel indicators and red (transmit) and green (receive) diodes located one on either side of a silver-handled toggle switch. There are commercially-available service manuals which will illustrate the interconnection of the two PCBs and the microphone.

Since the transceiver uses the same main PCB for transmit and receiver functions, the radio can be converted in the same manner as a switch-selected channel unit. One word of caution—the mike cord was prone to failure. Buy two.

Model 2716

This radio was known as the Hy-Gain 16 and was a

state-of-the-art advancement over the remote-controlled 2679. It was completely designed by Hy-Gain and was the first remote-microprocessor-controlled radio manufactured. The main PCB used could be operated with a conventional 40-channel switch or interconnected with a logic-control board to accept serial data from the microprocessor located in the microphone.

The transceiver featured 40-channel operation, two frequency memories, an emergency switch to override all functions and go to channel 9, PA function, a switchable noise blanker, and a clock.

The heart of the system was a National Semiconductor microprocessor which was bonded to the microphone PCB. National Semi manufactured this board. It has been advertised for sale for use of the clock only. Identification on the lower left corner of the foil side is MA6008-c. The trimmer cap, IC, and crystal and associated components on the foil side are the clock. Look at the crystal frequency carefully if you have one of the boards—it's a TV crystal adjusted by the cap to give nearly correct time. Much less expensive than using a special crystal running at exactly 3600 kHz.

All functions were activated by depressing the appropriate keys, with the channels slewing up or down, and the squelch and volume controlled by 16-step control circuits.

In addition to the microphone board, the interface board (750097 on foil side and 879499 on component side) and the main PCB (750096 on foil side and 879709 on component side) were interconnected to form the functional unit.

Since the main PCB can be made operational with a conventional channel-selector switch as used on other models, the following alignment procedure is provided. Should you be able to locate all of the components necessary to construct a complete unit, consult commercially-available service manuals for connections.

Transmitter Alignment
879709

This board uses a three-crystal frequency scheme. Q105 is an 11.8066-MHz oscillator which is tripled to function with the vco. Offset oscillator Q109 runs at 10.695 MHz, and PLL reference oscillator Q117 is at 10.24 MHz.

Step 1—Vco Adjustment

Connect a high-impedance VOM to TP8 (R114) and adjust T101 for 1.5 V indicated when set to channel one. Collector of Q108 should give a frequency reading of 37.66 MHz at this time.

Step 2—Pre-adjustment

Using a wattmeter or swr meter showing relative power output and a dummy load, turn L110 maximum clockwise and L106 clockwise until power output is approximately 2 Watts.

Step 3—Rf Alignment

Place in operation on channel 1 and adjust T111, L103, L104, T102, and T103, in order, for maximum power output. Reduce output by turning L106 clockwise if necessary to remain at no more than 2 W. Repeat several times if necessary to obtain maximum power output. Switch to position 40 and verify that power output is within 0.25 W of the position 1 reading.

Step 4—Final Circuit Alignment

Follow the instructions in Step 5 for board 27AOX.

Step 5—Modulation Adjustment

Using a scope or other modulation indicator connected to the antenna terminal, adjust RV102 for correct modulation. If a calibrated, modulated signal generator is available, connect to point 22 on the main PCB and set for 20 mV at about 1 kHz, and adjust for just under 100% modulation.

Step 6—Rf/S-Meter

An rf/S-meter can be used with this board by connecting between point 6B and ground on the main PCB. Adjust RV104 to calibrate the meter to the power indicated on the wattmeter.

This completes the transmitter alignment.

Receiver Alignment

Step 1—Vco Alignment

The vco circuitry is common to both transmitter and receiver and was covered in the oscillator-frequency check during transmitter alignment.

Step 2—Circuit Alignment

Connect an audio VOM to the speaker terminals or a high-impedance VOM to point 6B (or use the rf/S-meter installed previously) and ground. Using a frequency generator or a very attenuated transmitter set for a mid-channel, adjust, in order, T104, T105, L112, T106, T107, T108, and T109 for maximum audio output.

Component and Designation	Function		
Q101 MPS3704	vco	Q113 MRF472	Rf power amp
Q102 MPS6514	PLL mixer	Q114 MPS6514	Rf amp
Q103 MPS6513	Buffer	Q115 MPS6514	1st rec mixer
Q104 MPS6513	Buffer	Q116 MPS6513	2nd rec mixer
Q105 MPS6513	11.806-MHz oscillator	Q117 MPS6513	Ref oscillator, 10.24 MHz
Q106 MPS3704	AVR (Automatic Voltage Regulator)	Q118 MPS6514	1st i-f
Q107 MPS3702	Xmit switch	Q119 MPS5172	2nd i-f
Q108 MPS6513	Buffer	Q120 MPS5172	Squelch
Q109 MPS6513	10.695-MHz offset oscillator	Q121 MPS6514	Range boost
Q110 MPS6513	Xmit mixer	Q122 MPS6513	Xmt audio ALC
Q111 MPS6513	Pre-driver	Q125 2N5088	Noise-blanker gate
Q112 MPS-U02	Driver	Q126 2N5088	Noise-blanker amp
		IC101 MM48141	PLL
		IC102 TA7205P	Audio amp

Table 3. Components and functions for the 750096.

Repeat the adjustments as necessary.

Step 3—Squelch Adjustment

The squelch-adjustment circuitry was located on the control interface board. To make the squelch circuit functional, connect the wiper pin of a 10k pot to PCB point 7 and a 20k resistor in series between one of the pot IR pins and point 11 on the PCB. Last, connect a 10k pot (which will be the squelch control) between point Z and ground.

Turn the 10k pot completely clockwise and adjust the 20k pot (squelch calibrate) so that an S9 signal just breaks squelch. If a calibrated signal generator is available, input 50 uV at the antenna terminal and adjust for squelch break.

This completes alignment of the receiver portion of the board.

Should any of the boards fail to align properly, start troubleshooting from the front end of the receiver or transmitter sections to locate the trouble. Since these boards were in various stages of manufacture when operations ceased, they should be inspected carefully for damaged components or solder bridges.

In some models, the detector is a 1N4148 diode (usually found after the 2nd i-f amp Q119) and it is subject to infant mortality due to solder heat during assembly. If it is replaced, leave it standing up in the air on long leads and heat sink between the board and diode body.

That is the list of boards which many hams have converted. They are very well designed items, and if in proper condition and alignment should give very good service for a number of years. ■

PLESSEY- AVANTEK

PLESSEY INTEGRATED CIRCUITS

SL1610 RF Amplifier	3.05	SL1623 AM Det/AGC Amp	6.11	SL1640 Double Bal Mod	4.07
SL1611 RF Amplifier	3.05	SL1624 Multimode Det	6.17	SL1641 Receiver Mixer	4.07
SL1612 AF Amplifier	3.05	SL1625 AM Det/AGC Amp	4.07	SL1680 Xtal Maint Ckt	5.45
SL1613 Limiting Amp	4.38	SL1626 VOCAD/Sidetone	3.72	SL6600 IF Amp Det	6.78
SL1621 AGC Gen	4.07	SL1630 AF Amp	4.14	SL6640 FM Rcvr W Amp	4.41
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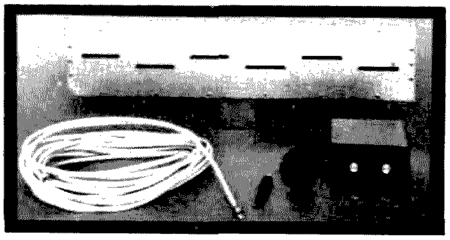

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OSCAR Pathfinder

— a colorful way to track the satellites

After purchasing my shiny New Apple II Plus last year, I went searching through my stacks of old *73 Magazines* for some good programs to run on it. To my amazement, there was an annoying lack of articles on this machine. (Hey, Apple owners what gives?) There were a lot of programs for other machines, but I didn't feel like going through the hassle of translating them. Besides, I wanted to use the graphics capability of the Apple, and the programs I found were not suitable for graphics. So I decided that a good way to get familiar with the machine and to offer something to other Apple hams would be to write my own program. Since I have always had a lingering interest in the OSCAR satellites, an OSCAR satellite tracking program became my objective.

The features I wanted my program to have were:

1) A graphics routine to display in real time the position of the satellite being tracked on a scale map of the US along with a simultaneous display of azimuth and elevation figures for an antenna array.

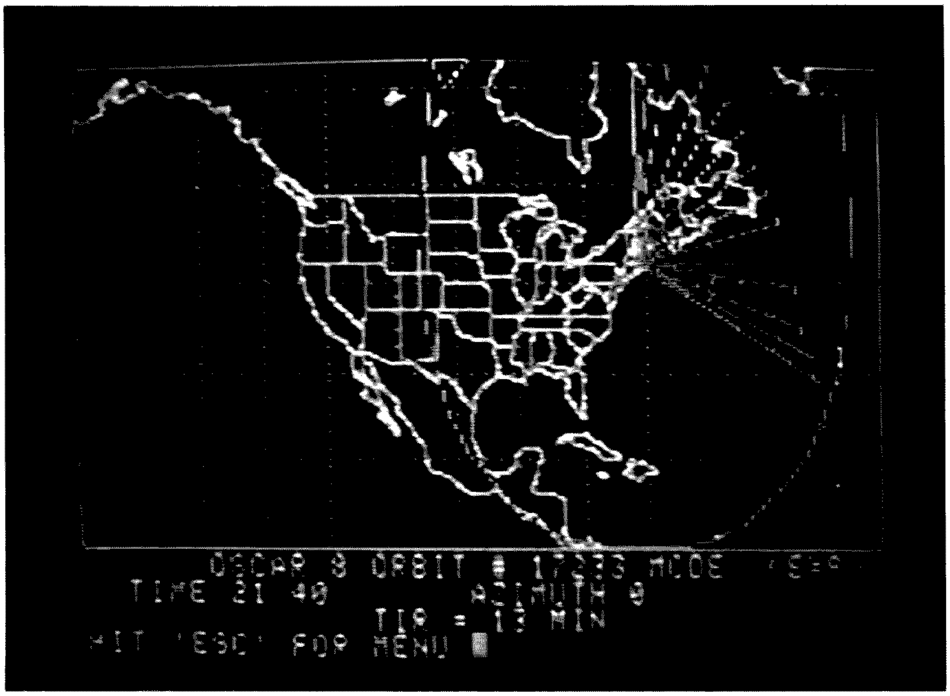
2) A routine to display a list of the azimuth and elevation figures for the orbit.

3) The equatorial crossing data for each of the orbits on the day selected.

4) A routine to display a list of the latitude and longitude of the satellite for each minute of the orbit.

Besides computing orbital data for OSCAR satellites, I wanted the capability to compute orbital data for any circular orbit satellite. Building on the basic ideas and research of the authors I have mentioned in the references, I came up with OSCAR Pathfinder.

Although the basics of the program came straightforwardly, there were two major obstacles I had to overcome before it would operate in the Apple. The first and most difficult to solve stemmed from the way the Apple memory is organized (see Fig. 1). As you can see, Hi-Res screen buffer 1 is located from 8192 to 16383. Hi-Res screen buffer 2 is located piggyback to that from 16384 to 24525. Basic programs start loading into memory at location 2048, filling up memory from there the way water fills a glass. LOMEM floats up through memory with the loading program like a cork floats up with the water. When the program is fully loaded, LOMEM is at the end of the program. Now, if the program is longer than 6K bytes, the end of the program extends up into and possibly beyond the screen buffers.



In the case of OSCAR Pathfinder, which is approximately 13K-bytes long, 7K of the program overlaps Hi-Res screen buffer 1. When the command HGR is encountered in the program, the buffer is cleared and *POOF!*—the last 7K of OSCAR Pathfinder goes off to the bit bucket.

Since the Hi-Res screens cannot be moved to another location in memory (at least as far as I know), the program must therefore be made to occupy another non-conflicting portion of

memory. With 48K of memory available, there is lots of room to use between the end of Hi-Res screen buffer 1 and DOS.

Ahah, but to get the program up there — that was the problem! Since LOMEM and HIMEM affect only the limits of variable and array space, it wouldn't help to move them around. After a lot of PEEKing, POKEing, hair pulling, and studying of the Apple manuals, I discovered the fact that the Apple uses software pointers to indicate the beginning and ending of BASIC programs in memory, along with other various pointers, all located in page Zero. Locations 103 and 104 ($67,$68) make up the pointer to the program's beginning address.

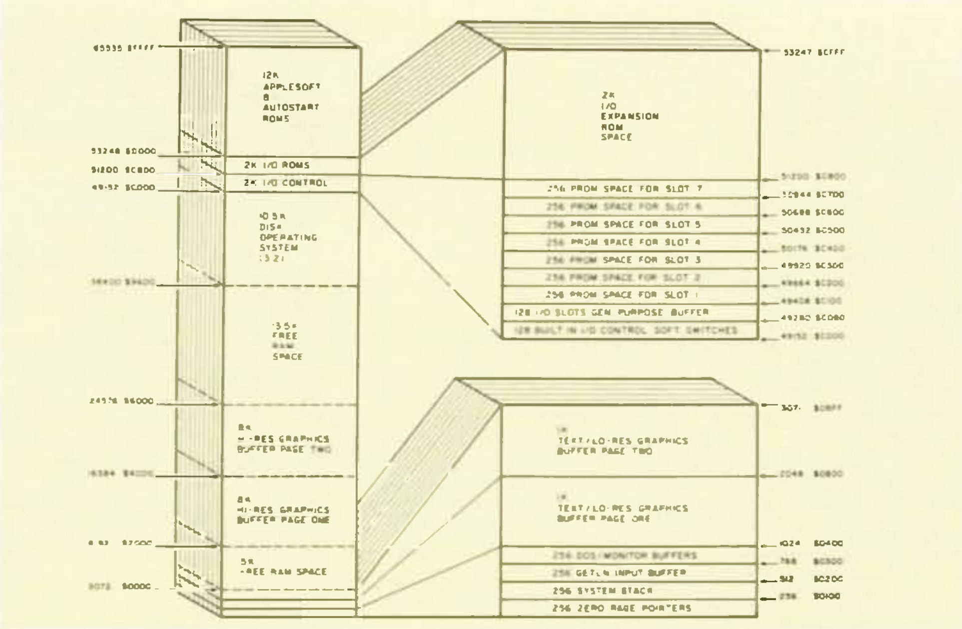


Fig. 1. 48K Apple II Plus memory organization.

After a little experimenting, I discovered that by changing the contents of this pointer I could control the location at which the BASIC programs start loading. *Success!* Now by typing the command "POKE 104,64:POKE 103,0:POKE 16384,0", I set the address of the beginning of a BASIC program to 16384, immediately following Hi-Res screen buffer 1. Since Hi-Res screen 2 is not used at all in OSCAR Pathfinder, I didn't have to worry about it causing any problems. OSCAR Pathfinder could then be loaded into memory and would reside from 16384 on up, with plenty of room left available for variables and arrays between the end of the program (LOMEM) and DOS (HIMEM).

This memory shuffling is accomplished by the small program, OSCAR STARTER, which appears in Listing 1. OSCAR STARTER will then cause the main program (Listing 2) to load from the disk and run.

The second major problem encountered was how to get an accurate scale map into the screen buffer for the program to plot on. I had two options that I knew of. One was to obtain one of those fancy sophisticated graphics digitizer tablets—which costs lots of bucks. The other was to do it by software—which costs lots of hours. Since I had lots more hours to burn than bucks, I chose the latter method. I decided that by using *lots* of HPLOT instructions, I could draw the necessary map.

The map I chose to put into memory was a Mercator projection because the latitude and longitude lines were straight, easing the math requirements to plot coordinates. In order to obtain the X, Y coordinates for the HPLOT commands, I traced the map on some graph paper which had a sufficient number of vertical and horizontal lines to provide reasonable resolution for the map. Then by numbering the vertical lines from 0 to 279 and the horizontal lines from 0 to 159, I was able to come up with the X,Y coordinates of all the major features of the map. (Believe me, that's a lot of dots!)

The resulting program is given in Listing 3. Since its length extends into Hi-Res screen buffer 1, either the same relocation method used to run OSCAR Pathfinder may be used or one could split the program in half and draw the map in two steps. Running the program results in a map of the US, Mexico, and Canada with latitude and longitude lines for every 10 degrees. To save this map for later use by OSCAR Pathfinder, first enter and run the program in Listing 3. Then use the BSAVE command to save the map on disk as a binary file. Use the file name "MAP 1." OSCAR Pathfinder will load the map as needed.

Operation

As you might already have deduced, OSCAR Pathfinder was originated on a 48K Apple II Plus machine with a single disk drive. When run, OSCAR Pathfinder first sets up variables, arrays, and formulas. Then it asks you for the data necessary for computation. The program computes the data for the orbit you select and then offers a choice of display modes.

The first information to be entered is the position of the station in longitude and latitude, in the range of −180 to 180 degrees and −90 to 90 degrees, with east longitude and south latitude entered as negative numbers. The data is checked to be sure it is in the proper range. Next, OSCAR Pathfinder asks the user for the date of the orbit to be computed. This is entered in six digits, two each for day, month, and year. The program checks the entry for proper range. Then the day of the week for the date entered is requested, to be used later in determining the mode of operation for the satellite.

OSCAR Pathfinder then requests the name of the satellite and, if it is not an OSCAR satellite, it then requests the orbital parameters for that satellite. The program asks for the northbound equatorial

```
5  HOME
10  POKE 104,64: POKE 103,1: POKE 16384,0
20  VTAB 10: PRINT "OSCAR PATHFINDER IN 48K APPLESOFT"
30  VTAB 12: PRINT TAB( 10)"USING DOS 3.2.1"
40  PRINT CHR$ (4);"RUN OSCAR PATHFINDER"
```

Listing 1.

Listing 2.

```
10  REM  *********************
20  REM  *                   *
30  REM  :  OSCAR PATHFINDER :
40  REM  *        BY         :
50  REM  *    T.C.JOHNSON    *
60  REM  :     --WB6NQK--    *
70  REM  *     NOV   1980    *
80  REM  *                   *
90  REM  *********************
210  POKE 33,40: POKE 34,0: HOME : TEXT : PRINT  CHR$ (4);"NOMONC,I,O"
300  VTAB 10: HTAB 12: PRINT "OSCAR PATHFINDER"
303  VTAB 11: HTAB 12: PRINT "----------------"
305  VTAB 12: HTAB 19: PRINT "BY"
310  VTAB 14: HTAB 15: PRINT "T.C.JOHNSON"
315  VTAB 16: HTAB 16: PRINT "-WB6NQK-"
320  VTAB 18: HTAB 16: PRINT "NOV 1980"
400  GOTO 540
500  REM  ERROR
510  HOME : FLASH : VTAB 12: HTAB 5: PRINT "ERROR # "; PEEK (222);" IN LINE "; P
EEK (218) +  PEEK (219) * 256: NORMAL
520  VTAB 20: HTAB 5: PRINT "HIT ANY KEY TO CONTINUE."; GET G$: PRINT G$;
530  POKE 216,0: CLEAR
540  ONERR  GOTO 500
1000  REM  DEFINE CONSTANTS
1010  DIM L%(52),MC%(1,53),RC%(1,35)
1020 L%(0) = 158:L%(1) = 156:L%(2) = 153:L%(3) = 151:L%(4) = 149:L%(5) = 146
1030 L%(6) = 144:L%(7) = 142:L%(8) = 140:L%(9) = 137:L%(10) = 135:L%(11) = 133:L
%(12) = 130:L%(13) = 128:L%(14) = 125:L%(15) = 123:L%(16) = 120:L%(17) = 118:L%(
18) = 115:L%(19) = 113:L%(19) = 110:L%(20) = 108
1040 L%(21) = 105:L%(22) = 103:L%(23) = 100:L%(24) = 97:L%(25) = 95:L%(26) = 92:
L%(27) = 89:L%(28) = 86:L%(29) = 83:L%(30) = 81:L%(31) = 78:L%(32) = 75:L%(33) =
 72:L%(34) = 69:L%(35) = 66
1050 L%(36) = 62:L%(37) = 59:L%(38) = 56:L%(39) = 52:L%(40) = 49:L%(41) = 45:L%(
42) = 42:L%(43) = 38:L%(44) = 35:L%(46) = 27:L%(47) = 22:L%(48) = 18:L%(49) = 14
:L%(50) = 10:L%(51) = 5:L%(52) = 0
1070 D$ =  CHR$ (4)
1080 D1$ = "SU":D2$ = "MO":D3$ = "TU":D4$ = "WE":D5$ = "TH":D6$ = "FR":D7$ = "SA
"
1090 R1 = 1.5708:R2 = 3.14159:R3 = 4.7124:R4 = 6.2832:R5 = 57.296:R6 = .01745:R9
 = 111.12:R7 = 3957:R8 = 1440
1100 M1$ = "B":M2$ = "A":M3$ = " (QRP)":M4$ = " (EXP)":M5$ = "J"
1110  DEF  FN ASN(X) =  ATN (X /  SQR ( - X * X + 1))
1120  DEF  FN ACS(X) =  - ATN (X /  SQR ( - X * X + 1)) + 1.57079
1130  DEF  FN AN(X) =  - ATN (X) + 1.5708
1140  DEF  FN DP(X) =  INT (X * 10 + .5) / 10
1150  DEF  FN MOD(A) =  INT ((A / 2 -  INT (A / 2)) * B + .05) *  SGN (A / 2)
2000  REM  OSCAR PATHFINDER MAIN ROUTINE
2020  POKE 33,40: POKE 34,0: HOME : TEXT : PRINT D$;"NOMONC,1,O"
2040  VTAB 1: HTAB 11: INVERSE : PRINT "OSCAR PATHFINDER": NORMAL
2050  POKE 34,1: HOME
2060  HOME
2070  VTAB 10: PRINT  TAB( 12)"STATION LOCATION": VTAB 11: PRINT  TAB( 12)"-----
-----------"
2080  VTAB 13: HTAB 5: INPUT "LONGITUDE (+ DEG W,- DEG E): ";A$: IF A$ = "" THEN
 2080
2090 SD(2) =  VAL (A$): IF SD(2) > 180 OR SD(2) <  - 180 THEN  VTAB 13: PRINT  S
PC( 40): GOTO 2080
2100  VTAB 15: HTAB 5: INPUT "LATITUDE (+DEG N,-DEG S): ";A$: IF A$ = "" THEN 21
00
2110 SD(1) =  VAL (A$): IF SD(1) > 90 OR SD(1) <  - 90 THEN  VTAB 15: PRINT  SPC
( 40): GOTO 2100
2120 SD(1) = SD(1) * R6:SD(2) = SD(2) * R6
2200  REM  GET SAT DATA
2210  HOME
2220  VTAB 12: PRINT  TAB( 2)"WHAT IS THE DATE OF THE ORBIT DESIRED?"
2230  VTAB 14: PRINT  TAB( 10)"DATE:(MMDDYY)        ]"
2240  VTAB 14: HTAB 24: INPUT DT$
2250  IF DT$ = "" THEN 2230
2260 DT =  VAL ( MID$ (DT$,3,2)): IF DT < 0 OR DT > 31 THEN 2230
2270 AX =  VAL ( LEFT$ (DT$,2)): IF AX > 12 OR AX < 0 THEN 2230
2280 DT$ =  LEFT$ (DT$,2) + "/" +  MID$ (DT$,3,2) + "/" +  RIGHT$ (DT$,2)
2290  POKE 34,1: HOME
2300  VTAB 12: HTAB 5: INPUT "WHAT DAY OF THE WEEK IS THAT?";A$
2310 DA$ =  LEFT$ (A$,2): IF DA$ <  > D1$ AND DA$ <  > D2$ AND DA$ <  > D3$ AND
DA$ <  > D4$ AND DA$ <  > D5$ AND DA$ <  > D6$ AND DA$ <  > D7$ THEN  HOME :: VT
AB 10: PRINT  TAB( 4)"DAY NOT RECOGNIZED": FOR I = 1 TO 3000: NEXT : GOTO 2290
2320  HOME : VTAB 8: HTAB 7: PRINT "NAME OF SATELLITE DESIRED:": VTAB 9: HTAB 7:
 PRINT "--------------------------": VTAB 13: HTAB 12: PRINT "1]  OSCAR 7": VTAB 1
5: HTAB 12: PRINT "2]  OSCAR 8": VTAB 17: HTAB 12: PRINT "3]  OTHER"
2330  VTAB 19: HTAB 12: PRINT "4]  QUIT": VTAB 8: HTAB 34: INPUT "";G$
2340  IF  VAL (G$) < 1 OR  VAL (G$) > 4 THEN 2320
2350  IF G$ = "1" THEN OS% = 7:OS$ = "OSCAR 7":ALT = 910:PER = 114.945:INC = 101
.7: GOTO 2390
2360  IF G$ = "2" THEN OS% = 8:OS$ = "OSCAR 8":ALT = 542:PER = 102.79:INC = 99.9
: GOTO 2390
2370  IF G$ = "4" THEN  END
2380  GOSUB 13000
2390 B =  INT (R8 / PER + .5): REM              ORBITS PER DAY
2400 C = (PER / R8) * 360 * R6: REM                  PRECESSION(RAD)
2410 D =  FN ACS(R7 / (R7 + ALT)): REM     SAT HORIZON (RAD)
2420  DIM AF(2,B),SSP(5, INT (PER + .5))
2430  GOSUB 8000: GOSUB 6000: GOSUB 5000
2440  GOSUB 6500
2450  VTAB 23: PRINT  TAB( 5)"WHICH ORBIT?(SELECT BY REF #):"
2460  VTAB 23: HTAB 35: INPUT A$
2470  IF A$ = "" THEN 2450
2480 AG =  VAL (A$): IF AG > B OR AG < 0 THEN 2460
2490  POKE 34,1: HOME
2500  VTAB 5: PRINT  TAB( 5)"NOW COMPUTING ORBITAL DATA FOR ": VTAB 7: PRINT  TA
B( 5)OS$;" ORBIT # ";AF(0,AG);" ON ";DT$
2510  VTAB 10: PRINT  TAB( 12)"PLEASE STAND BY..."
2520  VTAB 14: FOR I = 1 TO 40: PRINT "-";: NEXT
2530  VTAB 18: HTAB 5: PRINT "ORBITAL DATA COMPUTED FOR      ": VTAB 20: HTAB 5:
PRINT "OUT OF "; INT (PER + .5);" MINUTES OF THE ORBIT."
2540  GOSUB 7000
2550  POKE 34,1: TEXT : HOME : VTAB 5: PRINT  TAB( 5)"ORBITAL DATA NOW COMPUTED"
2560  POKE 34,5
2570  TEXT : HOME : VTAB 5: PRINT  TAB( 5)"THESE DISPLAY MODES ARE AVAILABLE:"
2580  VTAB 8: HTAB 5: PRINT "1] REAL TIME GRAPHICS": PRINT  TAB( 5)"2] HIGH SPEE
D GRAPHICS": PRINT  TAB( 5)"3] ANTENNA AZ/EL DATA": PRINT  TAB( 5)"4] SUBSATELLI
TE POINT DATA": PRINT  TAB( 5)"5] ORBITS FOR CURRENT DAY"
2585  VTAB 13: HTAB 5: PRINT "6] COMPUTE DATA FOR ANOTHER ORBIT": PRINT  TAB( 5)
"7] RESTART PROGRAM": PRINT  TAB( 5)"8] QUIT"
2590  VTAB 18: PRINT "  ANY CHOICE MAY BE ABORTED AT ANY      TIME BY HITTING TH
E 'ESC' KEY. HITTING  ANY KEY WHEN A ROUTINE IS COMPLETED WILLACCESS THE MENU."
2600  VTAB 24: PRINT  TAB( 20)"YOUR CHOICE?";: GET G$: PRINT G$
2610 G =  VAL (G$): IF G < 1 OR G > 8 THEN 2560
2620  ON G GOTO 4000,3000,3400,3600,2650,2440,2630,2640
2630  CLEAR : GOTO 1000
2640  END
2650  GOSUB 6500: GOTO 2600
3000  REM   HIGH SPEED GRAPHICS
3010  HGR : HOME : HCOLOR= 3
3015  PRINT  CHR$ (4)"BLOAD MAP 1"
3020  POKE 34,1: HOME
3030  IF FB% = 1 THEN 3070
3035  POKE  - 16303,0
3040  VTAB 10: HTAB 5: FLASH : PRINT "THE SATELLITE DOES NOT PASS": VTAB 11: HTA
B 5: PRINT "WITHIN THE BOUNDS OF THE MAP.": NORMAL : VTAB 12: PRINT  TAB( 5)"TO
DISPLAY THE MAP ALONE TYPE 'M'"
3050  GET G$: IF G$ = "M" THEN  HOME : POKE  - 16304,0:: VTAB 24: PRINT  TAB( 13
)"NEXT CHOICE?";: GET G$: PRINT G$
3060  GOTO 2560
3070  HOME : POKE  - 16304,0
3080  GOSUB 9000: GOSUB 9500: GOSUB 10000
3090  VTAB 21: PRINT  TAB( 7)OS$;" ORBIT # ";AF(0,AG);" MODE ";MO$
3100  IF TR = 0 THEN  HTAB 5: PRINT OS$;: FLASH : PRINT " NOT IN RANGE ";: NORMA
L : PRINT "THIS ORBIT": GOTO 3320
3110  GOSUB 10500
3120  VTAB 22: PRINT "HIT SPACE BAR WHEN READY TO START"
3130  VTAB 24: PRINT "HIT 'ESC' FOR MENU.";
3140  VTAB 24: HTAB 20: GET G$: PRINT G$;: IF G$ =  CHR$ (27) THEN 2550
3150  IF G$ <  >  CHR$ (32) THEN 3140
3160  VTAB 22: HTAB 1: CALL  - 868: VTAB 22: HTAB 3: PRINT "TIME:": VTAB 22: HTA
B 20: PRINT "AZIMUTH:"
3200  FOR I = AS(2) TO LS(2)
3210  HPLOT XS,YS TO MC%(0,I),MC%(1,I)
3220 T = SSP(0,I): GOSUB 12500:T$ =  LEFT$ (T$,5):AZ =  FN DP(SSP(4,I) * R5): VT
AB 22: HTAB 8: PRINT "       ": VTAB 22: HTAB 28: PRINT "       ": VTAB 22: HTAB 8
: PRINT T$: VTAB 22: HTAB 28: PRINT AZ
3280  FOR J = 1 TO 2:KB =  PEEK ( - 16384): POKE  - 16368,0: IF KB = 155 THEN 25
60
3290  NEXT
3300  PRINT  CHR$ (7); CHR$ (7);
3310  NEXT
3315  VTAB 23: HTAB 15: PRINT "TIR = ";TR;" MIN."
3320  VTAB 24: HTAB 20: GET G$: GOTO 2550
3400  REM   DISPLAY AZ/EL
3410  POKE 34,2: HOME : TEXT
3420  VTAB 3: PRINT  TAB( 5)OS$;" ORBIT # ";AF(0,AG);" ON ";DT$
3430  IF TR = 0 THEN  VTAB 12: HTAB 8: FLASH : PRINT "SATELLITE NOT IN RANGE.":
NORMAL : VTAB 14: PRINT  TAB( 8)"NO ANTENNA DATA AVAILABLE.": GOTO 3540
3440  VTAB 4: PRINT  TAB( 8)"ANTENNA DIRECTION DATA:"
3450  VTAB 5: PRINT "TIME(ZULU)      AZIMUTH           ELEVATION"
3460  VTAB 6: FOR I = 1 TO 40: PRINT "-";: NEXT
3470  POKE 34,6
3480 L = 6
3490  FOR I = AS(2) TO LS(2)
3500 L = L + 1: IF L > = 22 THEN 3550
3510 T = SSP(0,I): GOSUB 12500:AZ =  FN DP(SSP(4,I) * R5):EL =  FN DP(SSP(5,I) *
 R5)
3520  VTAB L: PRINT T$; TAB( 16);AZ; TAB( 32);EL
3530  NEXT
3540  VTAB 24: HTAB 20: GET G$: GOTO 2610
3550  VTAB 23: PRINT  TAB( 10)"HIT ANY KEY TO CONT.";: GET G$: PRINT G$: IF G$ =
  CHR$ (27) THEN 2610
3560  HOME :L = 7: GOTO 3510
3600  REM   DISPLAY SSP'S
3610  POKE 34,2: TEXT : HOME : VTAB 3: PRINT  TAB( 5)OS$;" ORBIT # ";AF(0,AG);"
ON ";DT$
3620 T = AF(1,AG): GOSUB 12500:L1 =  FN DP(AF(2,AG) * R5)
3630  VTAB 4: PRINT "TIME OF EQX:";T$;" EQX(LON W)";L1
3640  VTAB 5: PRINT "THE SUBSAT. POINTS FOR THIS ORBIT ARE:"
3650  VTAB 6: PRINT "   TIME            TIME       LAT       LON"
3660  VTAB 7: PRINT "(AFTER EQX)       (UTC)      (+N)      (+W) "
3670  VTAB 8: FOR T = 1 TO 40: PRINT "-";: NEXT
3680  POKE 34,8:L = 8
3690  FOR I = 1 TO  INT (PER + .5)
3700 L = L + 1: IF L < 22 THEN 3730
3710  VTAB 23: HTAB 10: PRINT "HIT ANY KEY TO CONT.";: GET G$: PRINT G$: IF G$ =
  CHR$ (27) THEN 2560
3720 L = 10: HOME
3730 T = SSP(0,I): GOSUB 12500:L1 =  FN DP(SSP(1,I) * R5):L2 =  FN DP(SSP(2,I) *
 R5)
3740  VTAB L: PRINT I;: HTAB 16: PRINT T$;: HTAB 26: PRINT L1;: HTAB 35: PRINT L
2
3750  NEXT
3760  VTAB 24: HTAB 20: GET G$: POKE 34,2: HOME : GOTO 2610
3770  GOTO 2610
3990  END
4000  REM   REAL TIME GRAPHICS
4010  HGR : HOME : HCOLOR= 3
4015  PRINT  CHR$ (4)"BLOAD MAP 1"
4020  POKE 34,1: HOME
4030  IF FB% = 1 THEN 4070
4035  POKE  - 16303,0
4040  VTAB 10: HTAB 5: FLASH : PRINT "THE SATELLITE DOES NOT PASS": VTAB 11: HTA
B 5: PRINT "WITHIN THE BOUNDS OF THE MAP.": NORMAL : VTAB 12: PRINT  TAB( 5)"TO
DISPLAY THE MAP ALONE TYPE 'M'"
4050  GET G$: IF G$ = "M" THEN  HOME : POKE  - 16304,0: VTAB 24: PRINT  TAB( 13)
"NEXT CHOICE?";: GET G$: PRINT G$
4060  GOTO 2560
4070  HOME : POKE  - 16304,0
4080  GOSUB 9000: GOSUB 9500: GOSUB 10000
4090  VTAB 21: PRINT  TAB( 7)OS$;" ORBIT # ";AF(0,AG);" MODE ";MO$
4100  IF TR = 0 THEN  HTAB 5: PRINT OS$;: FLASH : PRINT " NOT IN RANGE ";: NORMA
L : PRINT "THIS ORBIT": GOTO 4140
4110  GOSUB 10500
4120 T = AS(1): GOSUB 12500: VTAB 22: PRINT "HIT SPACE BAR WHEN TIME= ";T$;" (AO
5)"
4130  VTAB 23: PRINT "HIT 'ESC' FOR MENU."
4140  VTAB 24: HTAB 20: GET G$: IF G$ =  CHR$ (27) THEN 2550
4150  IF G$ <  >  CHR$ (32) THEN 4140
4160  VTAB 22: HTAB 1: PRINT  SPC( 40): VTAB 22: PRINT "TIME(UTC)      AZIMUTH
      ELEVATION": POKE 34,22
```

crossing (EQX) data for the reference orbit for the date selected earlier. This data is entered as (1) orbit number, (2) EQX time of day in the format HHMMSS, and (3) the EQX longitude with the west longitude being positive.

The program then computes the equatorial crossing data for each of the orbits for that date. The desired orbit number is selected from the list presented by entering the reference number associated with it. The program then begins its major number-crunching routines, generating latitudes, longitudes, bearings, and ranges for subsatellite points (SSP) in one minute intervals for the orbit, and computing elevation to the satellite for each minute the satellite is within range (above the horizon).

The computing time for SSP data is approximately 1.4 seconds for each minute of the orbit. For example, if the orbit is 100 minutes long, it would take about 2

```
4170  FOR I = AS(2) TO LS(2):T = SSP(0,I): GOSUB 12500:T$ =  LEFT$ (T$,5):AZ =
FN DP(SSP(4,I) * R5):EL =  FN DP(SSP(5,I) * R5): HOME : VTAB 23: PRINT T$; TAB(
16);AZ; TAB( 32);EL
4180 TC = LS(2) - I: VTAB 24: HTAB 12: PRINT "TIME TO LOS: ";TC;
4190  IF TC = 0 THEN 4310
4200  HPLOT XS,YS TO MC%(0,I),MC%(1,I)
4280  FOR J = 1 TO 2309:KB =  PEEK ( - 16384): POKE  - 16368,0: IF KB = 155 THEN
 2560
4290  NEXT
4300  PRINT  CHR$ (7); CHR$ (7)
4310  NEXT
4320  VTAB 24: HTAB 20: GET G$: GOTO 2550
5000  REM   FIND OSCAR MODES
5010  IF  LEFT$ (OS$,5) <  > "OSCAR" THEN MO$ = "N/A": RETURN
5020  IF OS% = 8 THEN 5080
5030  IF  FN MOD(AC) = 0 THEN MO$ = M1$
5040  IF  FN MOD(AC) = 1 THEN MO$ = M2$
5050  IF DA$ = D$(2) THEN MO$ = MO$ + M3$
5060  IF DA$ = D$(4) THEN MO$ = M4$
5070  RETURN
5080  IF DA$ = D2$ OR DA$ = D5$ THEN MO$ = M2$
5090  IF DA$ = D1$ OR DA$ = D7$ THEN MO$ = M5$
5100  IF DA$ = D3$ OR DA$ = D6$ THEN MO$ = M2$ + " & " + M5$
5110  IF DA$ = D4$ THEN MO$ = M4$
5120  RETURN
6000  REM  COMPUTE ALL ORBITS FOR DAY
6010 F = 1
6020  FOR I = 0 TO B
6030  FOR J = 0 TO 2
6040  ON J + 1 GOTO 6050,6070,6100
6050 AF(J,I) = AE(J) + F * I
6060  NEXT
6070 AF(J,I) = AE(J) + PER * I
6080  IF AF(J,I) > R8 THEN AF(J,I) = AF(J,I) - R8
6090  NEXT
6100 AF(J,I) = AE(J) + C * I
6110  IF AF(J,I) > R4 THEN AF(J,I) = AF(J,I) - R4
6120  IF AF(J,I) > R2 THEN AF(J,I) = AF(J,I) - R4
6130  IF AF(J,I) <  - R2 THEN AF(J,I) = AF(J,I) + R4
6140  NEXT
6150  NEXT
6160  RETURN
6500  REM  LIST ORBITS FOR DAY
6510  HOME
6520  VTAB 3: PRINT  TAB( 6)OS$;" ORBITS FOR ";DT$
6530  VTAB 4: PRINT "REF #   ORBIT#    TIME EQX     EQX(DEG W)"
6540  VTAB 5: FOR I = 1 TO 40: PRINT "-";: NEXT
6550  POKE 34,5:L = 5
6560  FOR I = 0 TO B
6570 L = L + 1: IF L > 22 THEN 6630
6580 T = AF(1,I): GOSUB 12500
6590 LD =  FN DP(AF(2,I) * R5)
6600  VTAB L: PRINT I; TAB( 9);;AF(0,I); TAB( 19);T$; TAB( 31);LD
6610  NEXT
6620  RETURN
6630  VTAB 23: HTAB 10: PRINT "HIT ANY KEY TO CONT. LISTING.";: GET G$: PRINT G$
;: HOME :L = 5: GOTO 6570
7000  REM   COMPUTE SUBSATELLITE DATA
7010 II = INC * R6:T = AF(1,AG):EQX = AF(2,AG):A% = 0:L% = 0:FB% = 0
7020  FOR I = 1 TO  INT (PER + .5)
7030 SSP(0,I) = T + I: IF SSP(0,I) > R8 THEN SSP(0,I) = SSP(0,I) - R8
7040 SSP(1,I) =  FN ASN( SIN (II) *  SIN (R4 * I / PER))
7050 BA =  COS (R4 * I / PER) /  COS (SSP(1,I))
7060  IF BA = 1 OR BA =  - 1 THEN SSP(2,I) = (.25 * I * R6) + EQX: GOTO 7080
7070 SSP(2,I) =  FN ACS(BA) + (.25 * I * R6) + EQX
7080  IF SSP(2,I) > R4 OR SSP(2,I) > R2 THEN SSP(2,I) = SSP(2,I) - R4
7090  IF SSP(2,I) <  - R2 THEN SSP(2,I) = SSP(2,I) + R4
7100 H = ALT + R7:N = SD(2) - SSP(2,I): IF N <  - R2 THEN N = N + R4
7110  IF N > R2 THEN N = N - R4
7120 SSP(3,I) =  FN ACS( SIN (SD(1)) *  SIN (SSP(1,I)) +  COS (SD(1)) *  COS (SS
P(1,I)) *  COS (N))
7130  IF SSP(3,I) < 0 THEN SSP(3,I) = SSP(3,I) + R2
7140 TA =  SIN (SSP(1,I)) - ( SIN (SD(1)) *  COS (SSP(3,I))):TB =  COS (SD(1)) *
  SIN (SSP(3,I)):TC = TA / TB
7150  IF TC <  - 1 THEN TC =  - .999999999
7160  IF TC > 1 THEN TC = .999999999
7170 SSP(4,I) =  FN ACS(TC): IF  SGN (N) =  - 1 THEN SSP(4,I) = R4 - SSP(4,I)
7180  IF SSP(3,I) <  = D AND A% = 0 THEN AS(1) = SSP(0,I):AS(2) = I:A% = 1
7190  IF SSP(3,I) > D AND L% = 0 AND A% <  > 0 THEN LS(1) = SSP(0,I):LS(2) = I:L
% = 1
7200  IF SSP(3,I) <  = D THEN SSP(5,I) = R1 -  ATN ((H *  SIN (SSP(3,I))) / (H *
  COS (SSP(3,I)) - R7))
7210  IF I = 1 THEN 7270
7220  IF SSP(1,I) >  = .15705 AND SSP(1,I - 1) < .15705 AND  SGN (SSP(2,I)) = 1
THEN YA = I
7230  IF SSP(1,I) <  = 1.0645 AND SSP(1,I - 1) > 1.0645 AND  SGN (SSP(2,I)) = 1
THEN YA = I
7240  IF SSP(1,I) > 1.0645 AND SSP(1,I - 1) <  = 1.0645 AND  SGN (SSP(2,I)) = 1
THEN YB = I - 1
7250  IF SSP(1,I) < .15705 AND SSP(1,I - 1) >  = .15705 AND  SGN (SSP(2,I)) = 1
THEN YB = I - 1
7260  VTAB 18: HTAB 31: PRINT I
7270  NEXT
7280 TR = LS(1) - AS(1)
7290  IF SSP(2,YA) < 2.7571 AND SSP(2,YB) > .586 THEN FB% = 1
7300  RETURN
8000  REM   INPUT REF ORBIT DATA
8010  HOME : VTAB 5: HTAB 5: PRINT OS$;" REFERENCE ORBIT DATA ": VTAB 7: HTAB 14
: PRINT "FOR ";DT$
8020  VTAB 10: HTAB 5: PRINT "ENTER ORBIT NO.(XXXXX):              ": VTAB 10: HTAB
28: INPUT "";A$: IF  LEN (A$) > 5 THEN 8020
8025  IF A$ = "" THEN 8020
8030 AE(0) =  VAL (A$)
8040  VTAB 12: HTAB 5: PRINT "ENTER EQX TIME(UTC)    :HHMMSS ": VTAB 12: HTAB 28:
 INPUT "";A$: IF  LEN (A$) <  > 6 THEN 8040
8045  IF A$ = "" THEN 8040
8050  IF  VAL ( RIGHT$ (A$,2)) > 59 OR  VAL ( RIGHT$ (A$,2)) < 0 THEN 8040
8060  IF  VAL ( MID$ (A$,3,2)) > 59 OR  VAL ( MID$ (A$,3,2)) < 0 THEN 8040
8070  IF  VAL ( LEFT$ (A$,2)) < 0 OR  VAL ( LEFT$ (A$,2)) > 23 AND  VAL ( MID$ (
A$,3,2)) > 59 THEN 8040
8080 T$ = A$: GOSUB 12000:AE(1) = T
8090  VTAB 14: HTAB 5: PRINT "ENTER EQX LONGITUDE    :       ": VTAB 14: HTAB 28:
INPUT "";A$: IF A$ = "" THEN 8090
8100  IF  LEN (A$) > 5 THEN 8090
8110  IF  VAL (A$) > 180 OR  VAL (A$) <  - 180 THEN 8090
8120 AE(2) =  VAL (A$) * R6
8130  RETURN
9000  REM   COMPUTE RANGE CIRCLE
9010 DD = D + D * .2
9020  FOR I = 0 TO 350 STEP 10
9030 K = I * R6
9040 RC =  COS (K) * DD + SD(1)
9050 RD =  SIN (K) * DD + SD(2)
9060 A =  INT (RC * R5 + .5):O = RD * R5
9070  IF A < 9 THEN A = 9
9080  IF A > 61 THEN A = 61
9090  GOSUB 11000
9100 RC%(1,I / 10) =  INT (X + .5):RC%(0,I / 10) = Y
9110  IF RC%(1,I / 10) > 279 THEN RC%(1,I / 10) = 279
9120  IF RC%(1,I / 10) < 0 THEN RC%(1,I / 10) = 0
9130  IF RC%(0,I / 10) > 159 THEN RC%(0,I / 10) = 159
9140  IF RC%(0,I / 10) < 0 THEN RC%(0,I / 10) = 0
9150  NEXT
9160  RETURN
9500  REM  PLOT RANGE CIRCLE
9510  HPLOT RC%(1,0),RC%(0,0)
9520  FOR I = 1 TO 35
9530  HPLOT  TO RC%(1,I),RC%(0,I)
9540  NEXT
9550  HPLOT  TO RC%(1,0),RC%(0,0)
9560  RETURN
10000  REM   PLOT PATH
10010  IF  NOT FB% THEN  RETURN
10020  FOR I = YA TO YB
10030 O = SSP(2,I) * R5:A =  INT (SSP(1,I) * R5 + .5): IF A < 9 OR A > 61 THEN 1
0120
10040  GOSUB 11000
10050  IF X < 0 OR X > 279 THEN 10120
10060  IF X = 0 AND Y = 0 THEN  HPLOT X,Y TO X + 1,Y TO X,Y + 1: GOTO 10120
10070  IF X = 279 AND Y = 0 THEN  HPLOT X,Y TO X - 1,Y TO X,Y + 1: GOTO 10120
10080  IF X = 279 THEN  HPLOT X,Y - 1 TO X,Y + 1 TO X - 1,Y: GOTO 10120
10090  IF X = 0 THEN  HPLOT X,Y - 1 TO X,Y + 1 TO X + 1,Y: GOTO 10120
10100  IF Y = 0 THEN  HPLOT X - 1,Y TO X + 1,Y TO X,Y + 1: GOTO 10120
10110  HPLOT X - 1,Y TO X + 1,Y TO X,Y - 1 TO X,Y + 1
10120  NEXT
10130  RETURN
10500  REM   COMPUTE BEARING LINES
10510 A = SD(1) * R5:O = SD(2) * R5: GOSUB 11000:XS = X:YS = Y
10520 DB(1) = ( ATN ((279 - S) / YS)) * R5
10530 DB(2) = 180 - (( ATN ((279 - XS) / (159 - YS))) * R5)
10540 DB(3) = 180 + (( ATN (XS / (159 - YS))) * R5)
10550 DB(4) = 360 - (( ATN (XS / YS)) * R5)
10600  REM   COMPUTE XY POINTS FOR BEARING LINES
10610  FOR I = AS(2) TO LS(2)
10620 A =  INT (SSP(1,I) * R5 + .5): IF A < 9 OR A > 61 THEN 10670
10630 O = SSP(2,I) * R5: GOSUB 11000:XP = X
10640  IF XP > 279 OR XP < 0 THEN 10670
10650 MC%(0,I) = XP:MC%(1,I) = Y
10660  NEXT
10665  RETURN
10670 BNG = SSP(4,I) * R5
10680  IF BNG > DB(4) OR BNG <  = DB(1) THEN MC%(1,I) = 0: GOTO 10720
10690  IF BNG > DB(1) AND BNG <  = DB(2) THEN MC%(0,I) = 279: GOTO 10750
10700  IF BNG > DB(2) AND BNG <  = DB(3) THEN MC%(1,I) = 159: GOTO 10780
10710  IF BNG > DB(3) AND BNG <  = DB(4) THEN MC%(0,I) = 0: GOTO 10810
10720  IF BNG > DB(1) THEN 10740
10730 MC%(0,I) = YS *  TAN (SSP(4,I)) + XS: GOTO 10660
10740 MC%(0,I) = XS - (YS * ( TAN (R4 - SSP(4,I)))): GOTO 10660
10750  IF BNG <  = 90 THEN 10770
10760 MC%(1,I) = YS + ((279 - XS) * ( TAN (SSP(4,I) - R1))): GOTO 10660
10770 MC%(1,I) = YS - ((279 - XS) * ( TAN (R1 - SSP(4,I)))): GOTO 10660
10780  IF BNG > 180 THEN 10800
10790 MC%(0,I) = XS + ((159 - YS) * ( TAN (R2 - SSP(4,I)))): GOTO 10660
10800 MC%(0,I) = XS - ((159 - YS) * ( TAN (SSP(4,I) - R2))): GOTO 10660
10810  IF BNG > 270 THEN 10830
10820 MC%(1,I) = YS + (XS * ( TAN (SSP(4,I) - R3))): GOTO 10660
10830 MC%(1,I) = YS - (XS * ( TAN (R3 - SSP(4,I)))): GOTO 10660
11000  REM    CONVERT LON-LAT TO X,Y
11010 X = 220 - ((O - 60) * 2.2353)
11020 Y = L%(A - 9)
11050  RETURN
11500  REM   CONVERT RADIANS TO DEGREES
11520 L1 = L1 * R5
11530 L2 = L2 * R5
11540  RETURN
12000  REM   TIME CONVERSION
12010  REM   (HHMMSS TO XXXX.XX MIN)
12020 T1 =  VAL ( LEFT$ (T$,2)) * 60
12030 T2 =  VAL ( MID$ (T$,3,2))
12040 T3 =  VAL ( RIGHT$ (T$,2)) / 60
12050 T = T1 + T2 + T3
12060 T =  INT (T * 100 + .5) / 100
12070  RETURN
12500  REM   TIME CONVERSION
12510  REM  (XXXX.XX TO HHMMSS)
12520 T1 =  INT (T / 60)
12530 T2 =  INT ((T / 60 -  INT (T / 60)) * 60)
12540 T3 =  INT ((((T / 60 -  INT (T / 60)) * 60) -  INT ((T / 60 -  INT (T / 60
)) * 60)) * 60 + .5)
12550 T1$ =  STR$ (T1):T2$ =  STR$ (T2):T3$ =  STR$ (T3)
12560  IF T1 = 0 THEN T1$ = "00"
12570  IF  LEN (T1$) = 1 THEN T1$ = "0" + T1$
12580  IF T2 = 0 THEN T2$ = "00"
12590  IF  LEN (T2$) = 1 THEN T2$ = "0" + T2$
12600  IF T3 = 0 THEN T3$ = "00"
12610  IF  LEN (T3$) = 1 THEN T3$ = "0" + T3$
12620 T$ = T1$ + ":" + T2$ + ":" + T3$
12630  RETURN
13000  REM  INPUT ALTERNATE SATELLITE DATA
13010  HOME : VTAB 10: PRINT "NAME OF SATELLITE:        ]        ": VTAB 10: HTAB
 19: INPUT "";A$:A$ =  LEFT$ (A$,7):OS$ = A$
13020  IF  LEN (A$) > 7 THEN OS$ = A$ +  RIGHT$ ("        ",7 -  LEN (A$))
13030  VTAB 12: INPUT "SAT. ALT.(STATUTE MILES):";A$: IF A$ = "" THEN 13030
13040 ALT =  VAL (A$)
13050  VTAB 14: INPUT "SATELLITE INCLINATION IN DEG.:";A$: IF A$ = "" THEN 13050
13060 INC =  VAL (A$)
13065  VTAB 20: HTAB 5: INPUT "IS ALL DATA CORRECT?";A$: IF  LEFT$ (A$,1) = "N"
THEN 13010
13070 PER = (R4 *  SQR (((ALT + R7) ^ 3) / 95600)) / 60
13080 OS% = 0: RETURN
```

minutes and 20 seconds to compute all the satellite data. (Try doing it in that time on your calculator!)

Display Menu

Finally, with all data computed, the program goes into the display mode, starting out with the display menu offering the choice of (1) real-time graphics, (2) high speed graphics, (3) azimuth-elevation list, (4) SSP data list, (5) orbits for the day, (6) compute data for another one of the orbits of the day, (7) start the program over, and (8) quit. If, while any of the display routines is running it becomes necessary to access the display menu again, pressing the ESC key will accomplish this. This allows one to jump around the display modes without having to wait for each one to finish.

If the real-time graphics choice is selected, the computer loads the map from the disk into the Hi-Res screen buffer 1. Then, if the satellite path is within the

Listing 3.

```
10  REM  ********************
20  REM  *                  *
30  REM  * US MAP GENERATOR *
40  REM  *                  *
50  REM  *  BY T.C.JOHNSON  *
60  REM  *                  *
70  REM  *      WB6NUK      *
80  REM  *                  *
90  REM  *     NOV 1980     *
95  REM  *                  *
97  REM  ********************
100  HOME : HGR : HCOLOR= 3: HPLOT 0,0 TO 279,0 TO 279,159 TO 0,159 TO 0,0
110  HPLOT 75,55 TO 75,56 TO 76,57 TO 76,58 TO 77,59 TO 77,66 TO 76,67 TO 76,72
TO 75,73 TO 75,74 TO 76,75 TO 76,80 TO 77,81 TO 77,83 TO 80,88 TO 80,89 TO 82,93
 TO 84,94 TO 84,96 TO 91,99 TO 93,102 TO 98,102 TO 105,105 TO 112,105 TO 112,104
120  HPLOT  TO 123,111 TO 124,110 TO 124,109 TO 127,109 TO 135,119 TO 136,119 TO
 136,115 TO 137,114 TO 137,113 TO 143,109 TO 149,109 TO 149,110 TO 152,110 TO 15
3,111 TO 154,111 TO 154,110 TO 153,109 TO 154,108 TO 155,108 TO 156,107
130  HPLOT  TO 160,107 TO 163,109 TO 165,109 TO 166,108 TO 167,108 TO 168,109 TO
 168,110 TO 169,111 TO 169,112 TO 168,113 TO 168,115 TO 171,118 TO 171,119 TO 17
3,121 TO 174,121 TO 175,120 TO 174,119 TO 174,118 TO 175,117 TO 174,116
140  HPLOT  TO 174,112 TO 174,110 TO 172,104 TO 173,103 TO 173,102 TO 177,100 TO
 177,99 TO 178,98 TO 180,98 TO 184,94 TO 184,89 TO 183,88 TO 185,87 TO 186,86 TO
 186,83 TO 187,83 TO 188,82 TO 188,80 TO 189,80 TO 190,79
150  HPLOT  TO 192,79 TO 192,78 TO 197,76 TO 197,75 TO 196,74 TO 196,72 TO 199,6
9 TO 204,67 TO 204,66 TO 203,65 TO 203,61 TO 202,60 TO 202,59 TO 199,59 TO 195,6
5 TO 186,66 TO 183,70 TO 181,72 TO 177,72 TO 177,73
160  HPLOT  TO 176,74 TO 168,77 TO 168,74 TO 169,73 TO 169,70 TO 168,69 TO 167,7
0 TO 166,70 TO 168,68 TO 168,67 TO 167,66 TO 167,65 TO 166,65 TO 165,64 TO 164,6
4 TO 164,65 TO 163,66 TO 162,66 TO 162,67 TO 160,69
170  HPLOT  TO 160,70 TO 161,71 TO 161,75 TO 159,76 TO 158,76 TO 158,72 TO 157,7
1 TO 158,70 TO 159,67 TO 159,65 TO 160,64 TO 162,63 TO 165,63 TO 165,61 TO 159,6
1 TO 158,60 TO 157,60 TO 157,59 TO 158,58
180  HPLOT  TO 156,59 TO 153,60 TO 152,61 TO 151,61 TO 150,59 TO 162,56 TO 160,5
6 TO 157,55 TO 156,54 TO 155,54 TO 154,55 TO 153,55 TO 152,53 TO 80,53 TO 80,57
TO 81,56 TO 77,56 TO 76,55
190  HPLOT 93,102 TO 93,107 TO 94,108 TO 94,109 TO 95,110 TO 96,110 TO 97,111 TO
 98,111 TO 98,113 TO 97,114 TO 96,114 TO 96,115 TO 98,116 TO 99,116 TO 100,117 T
O 101,117 TO 103,119 TO 103,120 TO 102,121 TO 103,122
200  HPLOT  TO 104,122 TO 105,123 TO 105,124 TO 106,124 TO 107,125 TO 107,126 TO
 108,126 TO 109,125 TO 109,124 TO 105,120 TO 105,119 TO 103,117 TO 103,116 TO 10
2,116 TO 102,113 TO 101,112 TO 100,112 TO 100,111 TO 99,111 TO 99,110
210  HPLOT  TO 98,109 TO 97,109 TO 97,102
220  HPLOT  TO 97,105 TO 99,105 TO 100,106 TO 103,112 TO 107,116 TO 109,117 TO 1
09,118 TO 108,119 TO 109,120 TO 110,120 TO 118,130 TO 118,134 TO 119,135 TO 119,
136 TO 120,137 TO 123,137 TO 124,138 TO 126,138 TO 129,141 TO 130,141
230  HPLOT  TO 131,142 TO 132,142 TO 133,143 TO 140,143 TO 141,142 TO 143,142 TO
 147,146 TO 148,146 TO 150,148 TO 152,148 TO 153,149 TO 157,149: HPLOT 167,149 T
O 167,144 TO 165,144 TO 164,143 TO 157,143 TO 156,142 TO 155,142 TO 155,141
240  HPLOT  TO 157,139 TO 157,137 TO 158,137 TO 158,134 TO 159,133 TO 159,130 TO
 153,130 TO 150,133 TO 150,135 TO 148,137 TO 144,137 TO 144,138 TO 143,138 TO 14
3,137 TO 140,136 TO 138,136 TO 138,133 TO 135,127 TO 135,119
250  HPLOT 167,126 TO 175,126 TO 177,128 TO 179,128 TO 181,130 TO 186,132 TO 187
,132 TO 187,133 TO 180,133 TO 180,132 TO 178,130 TO 170,128 TO 170,127 TO 164,12
9 TO 164,128 TO 167,126: HPLOT 190,133 TO 191,133 TO 192,134 TO 196,134
260  HPLOT  TO 196,135 TO 198,135 TO 199,136 TO 200,136 TO 200,137 TO 195,137 TO
 195,138 TO 194,139 TO 193,139 TO 192,138 TO 190,138 TO 189,137 TO 187,137 TO 18
8,136 TO 191,136 TO 191,135 TO 190,134 TO 189,134
270  HPLOT 178,137 TO 182,137 TO 182,138 TO 179,138
280  HPLOT 153,56 TO 154,56 TO 156,54 TO 159,54 TO 159,53 TO 160,53 TO 162,55 TO
 162,56 TO 164,56 TO 164,57 TO 165,58 TO 165,62 TO 168,62 TO 169,63 TO 171,63 TO
 172,64 TO 173,64 TO 174,65 TO 174,68 TO 173,68
290  HPLOT  TO 171,66 TO 171,70 TO 170,71 TO 170,72: HPLOT 169,75 TO 170,74 TO 1
76,74: HPLOT 177,71 TO 178,70 TO 183,70: HPLOT 189,65 TO 189,64 TO 194,60 TO 195
,60 TO 204,49 TO 208,49 TO 209,50 TO 213,50 TO 214,49 TO 220,50
300  HPLOT 202,54 TO 204,54 TO 205,53 TO 208,53 TO 209,52 TO 210,53 TO 210,55 TO
 209,56 TO 209,61 TO 210,60 TO 211,60 TO 212,61 TO 215,61 TO 215,64 TO 215,63 TO
 211,63 TO 211,62 TO 210,62
310  HPLOT 216,64 TO 217,64 TO 217,62 TO 218,61 TO 219,60 TO 219,63 TO 218,64 TO
 218,65 TO 217,66 TO 215,66 TO 213,68 TO 211,68 TO 210,69 TO 209,69 TO 209,71 TO
 206,71 TO 206,68 TO 207,68 TO 209,67 TO 209,64 TO 207,66 TO 205,66
320  HPLOT 210,51 TO 212,51 TO 213,52 TO 215,52: HPLOT 213,53 TO 216,53
330  HPLOT 78,55 TO 77,55 TO 77,54 TO 75,54 TO 72,51 TO 71,51 TO 71,50 TO 69,50
TO 69,49 TO 68,48 TO 67,48 TO 67,47 TO 73,47 TO 73,49 TO 74,50 TO 75,51 TO 77,51
 TO 77,52 TO 80,55
340  HPLOT 79,52 TO 78,51 TO 76,51 TO 76,50 TO 75,49 TO 75,48 TO 74,47 TO 71,47
TO 71,43 TO 68,45 TO 68,42 TO 63,37 TO 64,37 TO 64,36 TO 61,33 TO 61,30 TO 59,30
 TO 59,31 TO 57,31 TO 56,30
350  HPLOT  TO 56,29 TO 55,28 TO 55,27 TO 54,26 TO 55,25 TO 55,21 TO 54,22 TO 52
,22 TO 52,15 TO 52,18 TO 50,16 TO 48,18 TO 45,15 TO 45,13 TO 42,13 TO 42,12 TO 4
1,11 TO 40,11 TO 39,12 TO 38,12
360  HPLOT  TO 37,10 TO 33,10 TO 33,11 TO 31,11 TO 30,10
370  HPLOT 76,75 TO 105,75: HPLOT 85,75 TO 85,85 TO 97,95 TO 97,100 TO 96,101: H
PLOT 98,75 TO 98,92 TO 97,92 TO 97,94: HPLOT 91,75 TO 91,65 TO 92,65 TO 92,63 TO
 91,62 TO 91,53: HPLOT 78,62 TO 79,63 TO 84,63 TO 85,62 TO 91,62
380  HPLOT 93,54 TO 93,55 TO 94,56 TO 94,58 TO 95,58 TO 95,59 TO 96,60 TO 97,60
TO 97,64 TO 99,64 TO 99,66 TO 100,66 TO 100,68 TO 101,67 TO 105,67 TO 105,78 TO
125,78 TO 125,89 TO 123,89 TO 123,104 TO 116,104
390  HPLOT 110,78 TO 110,105: HPLOT 99,89 TO 142,89 TO 142,91 TO 184,91: HPLOT 1
05,66 TO 120,66: HPLOT 120,53 TO 120,70: HPLOT 120,62 TO 137,62: HPLOT 120,72 TO
 133,72 TO 134,73 TO 138,73: HPLOT 125,81 TO 140,81
400  HPLOT 123,91 TO 129,91 TO 129,94 TO 130,95 TO 130,96 TO 131,97 TO 134,97 TO
 135,98 TO 143,90: HPLOT 138,71 TO 149,71: HPLOT 140,79 TO 150,79
410  HPLOT 137,53 TO 137,64 TO 136,64 TO 138,65 TO 138,75 TO 139,76 TO 139,79 TO
 140,80 TO 140,82 TO 142,84 TO 142,98 TO 143,99 TO 143,103 TO 144,103 TO 144,109
: HPLOT 145,106
415  HPLOT 143,100 TO 150,100
420  HPLOT 149,60 TO 148,60 TO 148,62 TO 147,62 TO 147,63 TO 146,64 TO 146,65 TO
 147,66 TO 147,67 TO 148,68 TO 149,68 TO 149,71 TO 151,73 TO 151,77 TO 150,78 TO
 150,82 TO 153,87 TO 154,88
430  HPLOT  TO 154,91 TO 152,93 TO 152,95 TO 150,98 TO 150,102 TO 149,103 TO 149
,105 TO 153,105 TO 153,107 TO 154,108
440  HPLOT 152,74 TO 158,74 TO 158,85 TO 157,86 TO 157,87 TO 156,88 TO 156,89 TO
 155,89: HPLOT 160,75 TO 168,75 TO 164,75 TO 164,83 TO 163,84 TO 163,85 TO 161,8
7 TO 158,87
450  HPLOT 152,95 TO 173,95 TO 174,96 TO 176,96 TO 178,98: HPLOT 157,95 TO 157,9
8 TO 156,99 TO 156,107 TO 158,107 TO 158,105 TO 163,105 TO 163,106 TO 169,106 TO
 169,107 TO 170,107 TO 171,106
460  HPLOT 162,95 TO 162,97 TO 163,97 TO 163,100 TO 164,101 TO 164,102 TO 163,10
3 TO 163,105: HPLOT 170,92 TO 168,94 TO 168,96 TO 169,97 TO 169,99 TO 170,99 TO
173,102
470  HPLOT 175,75 TO 186,75 TO 186,81 TO 174,81 TO 174,76: HPLOT 165,84 TO 166,8
4 TO 167,85 TO 168,85 TO 170,83 TO 171,83 TO 173,81 TO 175,81 TO 175,83 TO 176,8
3 TO 177,82 TO 178,83 TO 179,83 TO 183,87
480  HPLOT 167,90 TO 168,89 TO 169,89 TO 169,87 TO 168,86 TO 170,88 TO 174,88 TO
 174,87 TO 175,87 TO 175,86 TO 178,83: HPLOT 190,66 TO 190,73 TO 189,74 TO 189,7
8 TO 188,78 TO 187,77
490  HPLOT 193,66 TO 191,72 TO 194,72 TO 194,66: HPLOT 190,75 TO 194,75 TO 194,7
7 TO 193,76: HPLOT 184,82 TO 184,84 TO 183,85 TO 183,87
500  HPLOT 142,10 TO 142,14 TO 143,15 TO 145,15 TO 146,16 TO 146,20 TO 147,20 TO
 147,23 TO 148,23 TO 149,22 TO 153,22 TO 153,23 TO 155,23 TO 158,27 TO 160,27 TO
 164,30 TO 170,30 TO 170,39
510  HPLOT  TO 171,40 TO 172,40 TO 172,41 TO 173,42 TO 173,43 TO 174,44 TO 176,4
4 TO 176,43 TO 177,43 TO 177,38 TO 176,37 TO 176,33 TO 175,32 TO 176,31 TO 178,3
1 TO 181,29 TO 183,26 TO 182,21
520  HPLOT  TO 181,20 TO 181,19 TO 178,17 TO 180,10: HPLOT 199,10 TO 199,15 TO 2
01,15 TO 201,16 TO 204,17 TO 206,16 TO 209,10 TO 210,10 TO 213,15 TO 213,17 TO 2
15,19 TO 216,20 TO 216,25 TO 215,26 TO 215,27
530  HPLOT  TO 217,27 TO 218,28 TO 218,29 TO 219,30
560  HPLOT 106,14 TO 106,16 TO 107,16 TO 108,15 TO 109,15 TO 109,14 TO 110,14 TO
 111,13 TO 113,13 TO 111,13 TO 109,12 TO 108,13 TO 107,13 TO 107,14
570  HPLOT 125,19 TO 125,24 TO 124,25 TO 123,24 TO 127,20 TO 126,19
580  HPLOT 128,38 TO 128,39 TO 129,39 TO 130,40 TO 130,42 TO 133,45 TO 133,47 TO
 134,48 TO 135,47 TO 134,47 TO 134,46 TO 134,43 TO 132,43 TO 132,42 TO 131,42 TO
 131,39 TO 129,37
590  HPLOT 133,36 TO 135,36 TO 137,36 TO 137,41 TO 137,42 TO 139,44 TO 139,45 TO
 138,48 TO 138,44 TO 136,41 TO 135,41 TO 133,41 TO 133,39 TO 134,38 TO 133,37 TO
 132,37
600  HPLOT 180,9 TO 180,6 TO 178,6 TO 178,5 TO 179,5 TO 180,4 TO 180,0 TO 191,0
TO 193,2 TO 194,2 TO 194,4 TO 195,5 TO 198,5 TO 198,6 TO 197,7 TO 197,8 TO 198,8
 TO 198,10
610  HPLOT 220,30 TO 222,30 TO 222,31 TO 224,31 TO 225,32 TO 224,33 TO 222,33 TO
 221,34 TO 221,35 TO 220,35 TO 220,36 TO 221,36 TO 222,35 TO 223,35 TO 224,34 TO
 226,34 TO 226,35 TO 227,36 TO 229,36
620  HPLOT  TO 229,41 TO 228,42 TO 228,43 TO 227,44 TO 223,44 TO 222,45 TO 222,4
7 TO 221,47 TO 220,48 TO 220,49
630  HPLOT 221,57 TO 231,57 TO 231,58 TO 230,58 TO 229,59 TO 231,59 TO 233,57 TO
 233,59 TO 234,60 TO 235,59 TO 235,56 TO 234,57 TO 234,55 TO 233,55 TO 235,53 TO
 235,54 TO 233,52 TO 234,51 TO 234,50
640  HPLOT  TO 230,50 TO 230,49 TO 228,49 TO 228,47 TO 229,46 TO 229,45 TO 228,4
5 TO 226,47 TO 226,48 TO 225,49 TO 225,50 TO 224,51 TO 223,51 TO 223,52 TO 222,5
3 TO 223,54 TO 221,55 TO 221,57
650  HPLOT 242,0 TO 244,2 TO 244,3 TO 245,3 TO 245,4 TO 246,5 TO 246,6 TO 247,5
TO 249,5 TO 250,6 TO 253,6 TO 252,7 TO 253,7 TO 253,9 TO 254,9 TO 254,10 TO 251,
10 TO 252,9
660  HPLOT  TO 252,7 TO 253,6 TO 253,2 TO 254,2 TO 255,0
670  HPLOT 29,9 TO 28,9 TO 27,8 TO 27,7 TO 25,7 TO 25,6 TO 24,5 TO 23,5 TO 21,7
TO 23,9 TO 21,9 TO 21,10 TO 19,10 TO 18,12 TO 16,12 TO 16,13 TO 13,13 TO 14,12 T
O 13,11
680  HPLOT  TO 14,10 TO 14,8 TO 16,6 TO 17,6 TO 18,5 TO 17,4 TO 15,6 TO 15,5 TO
13,7 TO 13,8 TO 12,9 TO 12,10 TO 11,10 TO 11,12 TO 9,12 TO 8,13 TO 8,14 TO 10,14
 TO 10,15
690  HPLOT  TO 9,16 TO 9,18 TO 5,20 TO 5,21 TO 0,23
700  HPLOT 158,150 TO 158,151 TO 159,152 TO 160,152 TO 160,153 TO 161,153 TO 162
,154 TO 162,155 TO 163,155 TO 164,156 TO 164,157 TO 165,157 TO 166,158 TO 166,15
9 TO 175,159 TO 176,158 TO 177,159 TO 180,159
710  HPLOT  TO 180,158 TO 179,158 TO 178,157 TO 177,157 TO 176,156 TO 174,158 TO
 173,158 TO 172,159 TO 171,158 TO 170,158 TO 168,156 TO 168,155 TO 166,153 TO 16
7,152 TO 167,150
720  HPLOT 143,9 TO 143,6 TO 144,5 TO 144,4 TO 147,1 TO 146,0
1000  FOR I = 18.8293539 TO 270 STEP 22.35294
1005  FOR J = 0 TO 159 STEP 5
1010  HPLOT I,J
1015  NEXT
1020  NEXT
1030  Y(2) = 49:Y(3) = 81:Y(4) = 108:Y(5) = 133:Y(1) = 10
1040  FOR I = 1 TO 5
1045  FOR J = 0 TO 279 STEP 5
1050  HPLOT J,Y(I)
1055  NEXT
1060  NEXT
```

bounds of the map, it draws the satellite path and range circle and displays the satellite name, orbit number, and mode of operation. The computer then requests the operator to press the space bar when the actual time of day matches that displayed on the screen (which is the time of Acquisition Of Signal—AOS). When that is done, the computer begins its real-time display procedure, during which it displays the current satellite position along the path, with a bearing line from the station to the current SSP, the time of day, the time remaining until Loss Of Signal (LOS), and current antenna azimuth and elevation figures. The computer updates all this information every minute until LOS.

If the high-speed graphics routine is selected, the computer performs basically the same operations as the real-time routine except that the speed of the updating is increased.

If the choice is made to display antenna direction data, then the Apple displays the azimuth, elevation, and associated time of day for each minute the satellite is in range.

The choice to display SSP data displays the time after EQX, time of day, and longitude and latitude of each SSP for each minute of the orbit.

The choice to display all orbits will display the same list of data for all the orbits for the day selected.

If you choose to compute another orbit, the program retains all satellite parameters and displays the orbit list, allowing the operator to select another one of the orbits for that day.

Choosing to restart clears all variables and starts the program over from the beginning.

Finally, a choice to quit will do just that, stopping the program immediately.

Program Structure

This program is constructed of fifteen separate software modules, each with a specific job as indicated below.

1000 Initiates all variables, arrays, constants, and functions.

2000-4000 Main routine.

5000 Determines the mode of operation for OSCAR 7 or 8. (OSCAR 7 is now out of operation, of course.)

1) Subpoint latitude

$LAT = \arcsin[\sin(Inc)\cdot\sin(360T/PER)]$

T = time after EQX

PER = period time

2) Subpoint longitude (Earth rotation is .25T)

$$LON = \arccos\left[\left(\frac{\cos(360T/PER)}{\cos(LAT)}\right) + (.25T) + L_{EQX}\right]$$

L_{EQX} = longitude at EQX

3) Distance from station to subpoint

$DIST = \arccos[(\sin(A)\sin(B) + \cos(A)\cos(B))\cos(L)]$

A = LAT of first point (station) (+90° to −90°)

B = LAT of second point (SSP) (+90° to −90°)

L = LON of first point − LON of second point

DIST units is in great circle arc degrees radians

4) Bearing from station to subpoint

$$BNG = \arccos\left[\frac{\sin(B) - \sin(A)\cos(DIST)}{\cos(A)\sin(DIST)}\right]$$

If L in formula 3 was negative then the bearing = 360° − BNG

5) Elevation to satellite

$$ELEV = 90 - \arctan\left[\frac{H \times \sin(DIST)}{H \times \cos(DIST) - 3957)}\right]$$

H = Earth radius + satellite altitude

6) Distance to satellite

$$RNG = \left[\frac{H \times \cos(DIST) - 3957}{\cos(90 - ELEV)}\right]$$

RNG is in statute miles

7) AOS/LOS range (horizon of satellite)

$$D = \arccos\left(\frac{R}{H}\right)$$

R = Earth radius (3957 miles); D is in great circle degrees

8) $$PER\ time = \left(2\pi \times \sqrt{\left(\frac{(H)^3}{9.56 \times 10^4}\right)}\right)/60$$

PER is in minutes

9) $$Precession\ of\ Earth\ per\ orbit = (PER \times .25)^\circ \left(\frac{360^\circ}{1440min}\right) = .25$$

10) Orbits per day = 1440/PER

Fig. 2. Formulas.

SD(1) = station latitude
SD(2) = station longitude
RC%(1,36) range circle plotting points; RC%(0,X) = Y coordinate; RC%(1,X) = X coordinate
AE(0) = orbit#; AE(1) = time of EQX; AE(2) = EQX longitude
AF(2,B) data for orbits for the day requested
AF(0,X) = orbit#; AF(1,X) = time of EQX; AF(2,X) = EQX longitude
B = no. of orbits per day
SSP(5,PER) = subsatellite point data for orbit
SSP(0,X) = time of day; SSP(1,X) = LAT; SSP(2,X) = longtitude; SSP(3,X) = distance
SSP(4,X) = azimuth; SSP(5,X) = elevation
PER = satellite orbital period in minutes
X—denotes each minute of orbit
Latitude & longitude are in radians
Distance is in great circle radians
Azimuth and elevation is in radians
L%(53) map latitude to Y coordinate-conversion constants
MC%(1,53) = satellite path plotting points
MC%(0,X) = X coordinates
MC%(1,X) = Y coordinates
D1$ to D7$ = days of week D1$ = "SU"; D2$ = "MO"; etc.
M1$ to M5$ = OSCAR operating modes
AS(1) = time of acquisition of signal (UTC); AS(2) = time after EQX(min) for AOS
LS(1) = time of loss of signal (UTC); LS(2) = time after EQX(min) for LOS
TR = time in range (LS(2) − AS(2))
AG = selected orbit
R1 = 1.5708; R2 = 3.14159; R3 = 4.7124; R4 = 6.2832; R5 = 57.296; R6 = .01745; R7 = 3957; R8 = 1440; R9 = 111.12
MO$ = OSCAR mode of operation—made up of M1$ to M5$
DA$ = day of week
DT$ = date of orbit (MM/DD/YY)
OS% = satellite selected
OS$ = satellite name
ALT = satellite altitude in statute miles
INC = satellite orbit inclination (in radians)
C = satellite precession degrees per orbit (in radians)
D = satellite horizon (in great circle radians)
D$ = control (D for DOS)

Fig. 3. Variables, arrays, and constants used in OSCAR Pathfinder.

6000 Lists the orbits and EQX data for all orbits of the day.
7000 Computes SSP data. This is the main math routine. It computes the time of day for each point, stored in array SSP(0,I); latitude, stored in SSP (1,I); longitude, stored in SSP (2,I); distance from station to subsatellite point, stored in SSP(3,I); and true bearing from station to subsatellite point, stored in SSP(4,I) for each minute of the orbit. It checks to see if the satellite is in range and, if it is, it computes the elevation, stored in SSP(5,I), and sets up pointers to AOS and LOS time. "I" in the arrays corresponds to the time in minutes after EQX. The subroutine also checks to see if the satellite path will take it within the bounds of the map and, if it does, it sets up pointers to when it enters and leaves the map bounds (YA and YB). Finally, it computes the time in minutes that the satellite is in range.
8000 Used to input reference orbit data: orbit number, time of day of EQX, and EQX longitude.
9000 Computes X,Y coordinates for the range circle to be displayed on the map.
9500 Draws the range circle on the map.
10000 Draws the satellite path on the map.
10500 Computes X,Y coordinates for drawing bearing lines from station location to each SSP. Stored in MC%(0,I) and MC%(1,I).
11000 Converts longitude and latitude figures to X and Y coordinates.
12000 Converts time in the form of hours, minutes, and seconds to the form of minutes after midnight.
12500 Converts time in the form of minutes after midnight to hours, minutes, and seconds.
13000 Accepts data needed to compute orbit data for satellites other than OSCAR. Satellite altitude, inclination, and name must be entered.

The formulas used in these routines are detailed in Fig. 2. The major arrays and variables being used are detailed in Fig. 3.

Have Fun!

I hope you can make some use of this program as I have. I have been using it regularly to predict OSCAR positions and I've also used some of the techniques in other programs.

If you really want to get OSCAR Pathfinder running with the least amount of effort, you can send me $15 and I'll ship you a disk with everything on it ready for turnkey operation. If you have any questions that I haven't answered here, send me an SASE and I'll see if I can help you out. Have fun! ■

References
1. "Track OSCAR With Your SR-52," Art Burke W6IX, *73 Magazine*, November, 1977.
2. "Track OSCAR 8," Kazimierz J. Deskur K2ZRO, *73 Magazine*, November, 1977.
3. "Tracker—The Ultimate OSCAR Finder," Bruce Nazarian WD8DRK, *73 Magazine*, January, 1981.
4. "Orbits and Revolutions," *NASA Facts*, NASA.

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Which TVRO Antenna Is Best?

—Satellite Central, part IV

In the past few months, I've received dozens of letters from hams wanting to know which antenna is best. Since it's easy to get stung, you must know what to ask for and, in many cases, to demand!

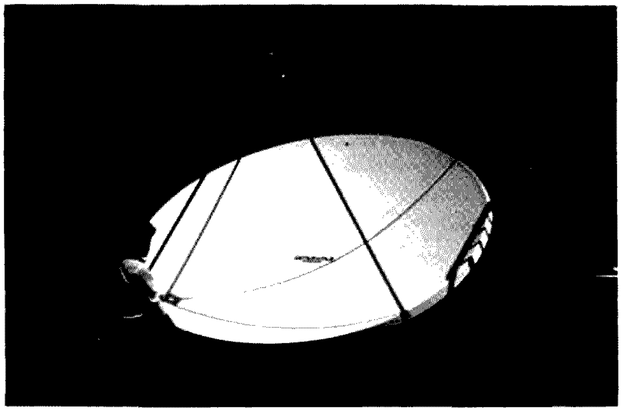
The $100 Receiver!

December's mail was heavy, mostly due to my mention of the $100 receiver design by Rex Roads. Well, Rex is busy cleaning up the drawings and we have a complete construction article planned for late spring. In the meantime, start looking for a site for your $100 dish. We've got one of those coming, too.

Let's cover the kinds of antennas you'll likely find in TVRO service and then move on to selection tactics in my next article. All things considered, you need about 40 dB antenna gain at 4 GHz for domestic birds, with more gain necessary as you move off the prime coverage footprints.

The situation is aggravated by the need to shield the antenna from noise on all sides except the main lobe. Down in the dc bands, antenna side-lobe response is usually something you ignore unless you want maximum efficiency or enjoy climbing the tower to prune beam elements! You must pay attention to this problem in TVRO work because the signals you want are well below the terrestrial noise floor in the vicinity of the antenna. Typical signal levels are 30 dB *below* the surrounding noise. It's like trying to hear a normal conversation in a room full of people shouting at you! More gain won't help.

The solution is to build a dish reflector large enough to produce a very narrow beamwidth. Then use some plumbing in the form of a feedhorn to channel the signal to a shielded monopole antenna probe. Several antenna designs can be used. All of them work, but you must study them carefully.



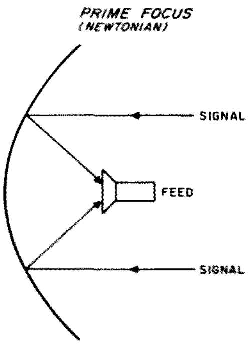


Fig. 1. The prime-focus design uses a parabolic reflector to concentrate the signal from the satellite into a small area known as the focus point. The accuracy of the dish surface to a true parabolic curve governs the size of the focus point and placement of the feedhorn.

A Tempting Menu of Dishes

Fig. 2. The Cassegrain or twin-reflector design offers increased efficiency, but there are limits. As a rule, Cassegrains must be larger than ten feet before you can derive any benefit because the subreflector blocks a significant portion of the signal from ever reaching the dish.

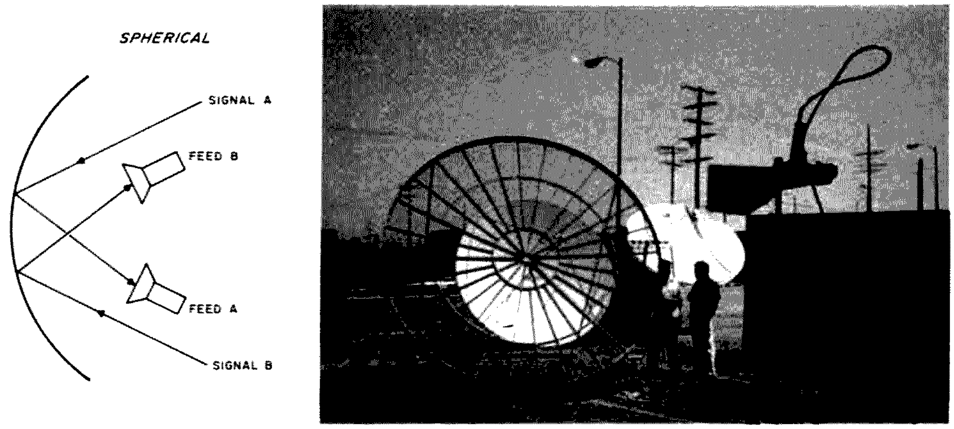


Fig. 3. Carve out a piece from a very large metal ball and you have the spherical antenna. It is possible to receive several satellites at once using separate feeds or you can simply mount the feed and LNA on a tripod and move it from satellite to satellite.

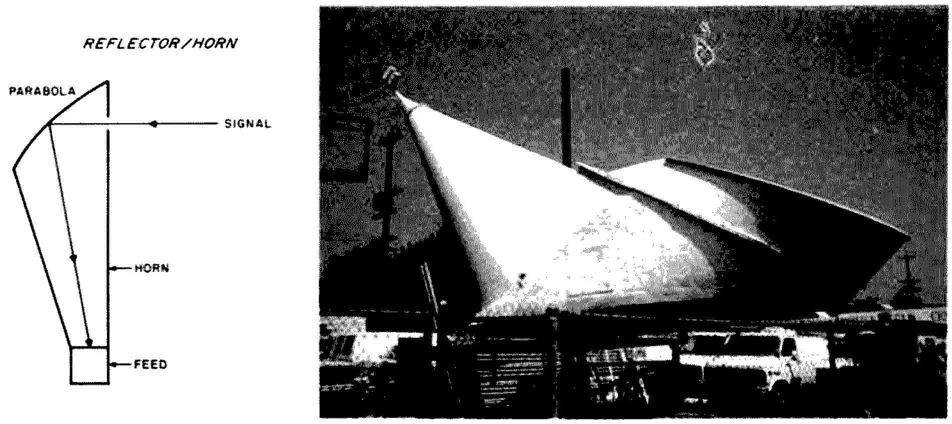


Fig. 4. The horn/reflector antenna is just a segment of a parabola fed by a very long horn. It has been in use for many years by A.T. & T. and other terrestrial microwave users. This design is considered by many as the ideal solution to high gain and low side-lobe response.

The prime-focus design seen in Fig. 1 is by far the most popular TVRO antenna today. The surface is formed into a parabolic curve so that the reflected signal travels the same distance to the focus point where it enters the feedhorn opening. The distance from the reflector to the focus point is referred to as the focal length. The formula for a parabola is available out of many trig or calculator instruction books. It is easy to apply the formula to a wood or masonite template and to build a working dish from wood and window-screen material in a few evenings. Prime-focus dishes are simple to build, and they may have very good side-lobe properties if you are careful with construction and feed selection.

Next, we have the Cassegrain, or two-reflector, dish seen in Fig. 2. Most commercial satellite stations use this design because overall efficiency can be improved by additional contouring of the hyperbolic subreflector and, in some cases, modifying the curve of the main reflector. Cassegrains can have very good directivity and may, with very special design, achieve low side-lobe response as well as greater gain than equivalent-sized prime-focus models. This slight advantage is due in part to the longer focal length and reduced area presented to the feed.

Building a Cassegrain may be harder because you now have two reflectors that must be in perfect alignment before the signal can reach the feed. That is, the focus point of the main reflector (parabolic) must coincide with the back focus point of the subreflector (hyperbolic). As a rule, Cassegrain subreflector sizes are between 10 and 20 percent of the diameter of the main reflector, but the main reflector must be larger than ten feet before you can derive any benefit. So the subreflector presents a real problem since it blocks a significant portion of the signal from ever reaching the dish! This phenomenon is known as aperture blockage and is the one factor that keeps the Cassegrain from becoming popular in dish sizes below 4 meters.

Perhaps the most interesting style in use today is the spherical antenna. The late

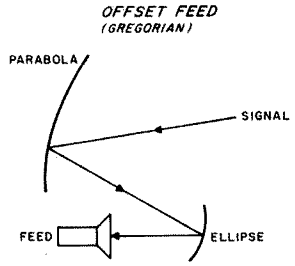


Fig. 5. The offset feed dish is similar to the Cassegrain in the two-reflector configuration, though single-reflector versions are also used. Side-lobe response is greatly improved because of a lack of aperture blockage.

Oliver Swan developed a practical approach to this design. The spherical holds the unique advantage of being able to receive several satellites at once—but separate feeds are required, as shown in Fig. 3. It is possible to place a spherical so that it can see almost a 40-degree arc of the Clarke belt. Then you simply move the feed in an arc to move from satellite to satellite.

The spherical looks almost like a flat plate or a very long focal length parabola. Mere inches keep either statement from being true. Despite the hassle of poor side-lobe response, the spherical offers an easy way for the home constructor to get his antenna built at minimum cost. Instead of using a parabolic curved template, one simply uses a wire stretched from some distant radius point to adjust and check accuracy.

Ma Bell, on the other hand, has a lot of experience with 4-GHz signals. Her horn/reflector, or Hogg horn (named after one of the inventors), is shown in Fig. 4. This design embodies high gain and excellent side-lobe response. It's just about the only style that will work in a metropolitan area where interference is rampant. Unfortunately, the Hogg is a beast to mount! A typical 4.5-meter-aperture unit may have an overall length of 34 feet. Your backyard has got to be very large or else the barbecue must go!

Fig. 6. Nearly ideal reflector surfaces are possible when flame-spraying is applied to fiberglass dishes. Care must be used in the coating as well as curing time for the resin to ensure that the dish will follow the proper curve within 1/8 inch.

Another design used in commercial applications is the offset parabolic seen in Fig. 5. The feedhorn does not get in the way of the signals, thus improving the gain and reducing side lobes. The modified torus is finding use in cable TV and military installations where several signals may be needed with about equal efficiency. Each design has its own unique advantage and price tag!

What Materials Work For Dishes?

Just about any reflective surface will work, but some obvious concern can develop when you look at a fiberglass dish. Some designs use mesh or sheet-metal reflectors imbedded in the fiberglass. Others may use a metal film applied by a technique known as flame-spraying—as seen in Fig. 6. Flame-spray may improve the accuracy of the dish geometry, but there is no easy way to know how well the coating was applied. It's easy to get sloppy. I've tested dishes where large sections had no reflective properties at all!

On the other hand, a dish constructed of mesh screen may not follow a parabolic or spherical curve over the entire surface. This is especially true of window-screen designs. The mesh bends easily and must be applied in flat sections. Despite the claims of many manufacturers, a flat section cannot possibly work as well as one which follows a parabolic or spherical curve. Why, then, do some mesh dishes work? The secret is simply in the number of sections used. More sections come closer to the overall desired curve. Interestingly enough, gain loss is not the big problem with window-screen designs. Using fewer sections affects the side-lobe response of the dish more than it does the gain!

How big can the holes in the mesh be? Good question. Logically, they must be big enough to appear as a reflective surface to the wavefronts. If we go back to the books, we can think of the holes as waveguides beyond cutoff and simply make them progressively smaller until microwaves don't slip through. The bottom line is about 1/8-inch-diameter holes. Anything larger does not reflect nearly as well.

Solid spun-metal dishes are by far the best. Their accuracy and reflective properties outweigh their unwieldiness. The only catch is that large spun dishes are nearly impossible to find. The surplus market top-ends at the ten-foot mark.

The next best bet in materials is metal petals. They reflect just as well as anything else, but you must use care during assembly or they may not accurately follow the dish curve. Bending, twisting, and sweating are normal occurrences when you try to put one of these types together!

What About Feedhorns?

Fig. 7 shows some typical feedhorns. Their primary purpose is to efficiently couple most of the signal bouncing off the reflector into the LNA. But therein lies the problem and perhaps the first place you may want to try to improve basic TVRO-antenna design. You see, the feedhorn, like the dish, has its own sensitivity pattern, too. Like any antenna, they are most sensitive on axis, tapering off at the sides. The key to feed efficiency is in the taper. Remember, we want to receive a signal that is well below the terrestrial noise floor. And the feed overshoot seen in Fig. 8 would indeed intercept the noise we want to reject.

So what do you do if all feeds overshoot? The trick is in finding a happy medium of gain and efficiency versus noise intrusion. Let's assume for the moment that the feed is designed to taper off sensitivity so that the edges of the main dish reflector just intercept the 10-dB points on the feed pattern. Visualize the situation where the feed is most sensitive to signals bouncing off the center of the reflector, but less sensitive to signals at the edges. This problem has kept feed designers working in the wild quest for the ideal curve seen in Fig.

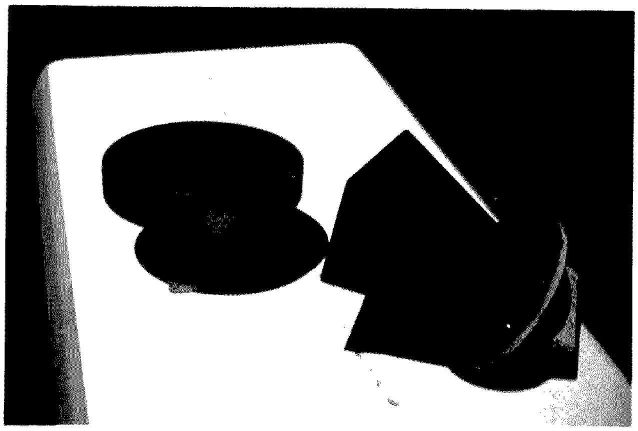


Fig. 7. Feeds may take on various shapes, but their sole purpose is to properly illuminate the dish. I had a chance to test several of the feedhorns sold today. My spectrum analyzer showed a drastic difference in gain and efficiency on my particular dish, so feed matching to the dish is important.

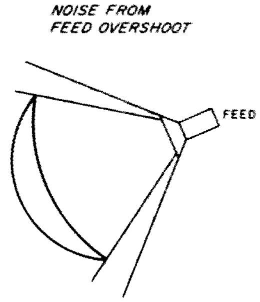


Fig. 8. Better efficiency achieved by a broader feed beam will only cause overshoot and increase intercepted terrestrial noise. The best compromise is about a 10-dB drop at the edge of the dish. A metal shroud around the rim of the dish can block some noise seen by the feed.

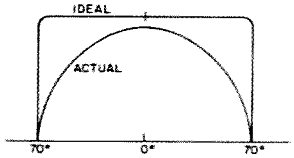
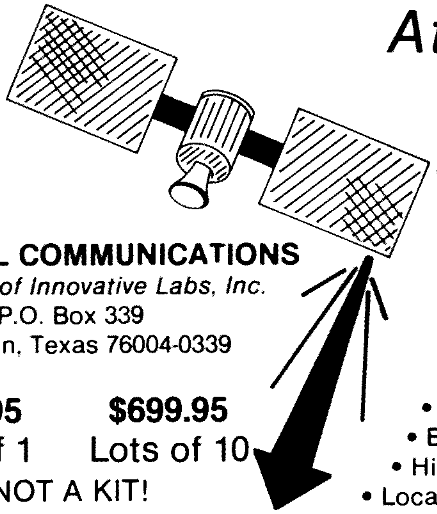


Fig. 9. Typical feed-pattern sensitivity just covers the dish at the 10-dB points. This means that the dish is less efficient at the edges. Nearly 100 percent antenna efficiency would be possible if you could achieve the ideal curve and still eliminate feed-phase taper, aperture blockage, and reflector-surface errors.

9—one that tapers off like a steep ledge rather than a rolling hill.

Perhaps the most interesting outcome from recent feed design advances has been the radical departure from the classic flared waveguide approach. Look at any dish and you will realize that because the dish is circular, the wavefront reflected into the feed will be also! So "circular-to-waveguide" transitions in feed are becoming the rule rather than the exception.

This deviation from the classic rectangular feed can boost overall antenna efficiency to nearly 60 percent. Is that all? Higher efficiency is possible and, in fact, within reach if you can make better use of the surface near the edge of the dish. The two-reflector, or modified Cassegrain, design is a step in that direction. But the problems of proper amplitude illumination and equal phase paths over an unobstructed reflector aperture are still there. For the moment, it appears that matching a feed to a dish is like fitting a round peg in a square hole. A hammer won't help! ■



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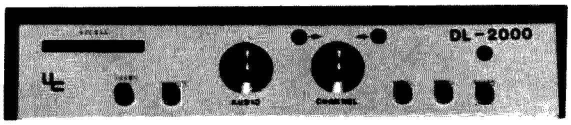

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If you liked our low-noise amplifier article in the February, 1982, issue of *73* ("Job's Own LNA"), you will love our no-alignment downconverter.

This downconverter can be built by an average technician and the parts are readily available. The local oscillator (LO) and the mixer are commercial units manufactured by Magnum Microwave Corporation of Sunnyvale, California. The design features a dc block for feeding power to your LNA, and it can be built for less than $225. With this downconverter, an LNA, and a good antenna, you can receive noise-free pictures from the satellites.

The converter takes the 3.7-to-4.2-GHz signal from the LNA and converts it to a 70-MHz i-f signal. The design features single conversion for simplicity and ease of duplication. The local oscillator is voltage-tuned, and there is no alignment required. You put the parts on the board, mount it in the box, power it up, and watch the birds! How simple can you get?

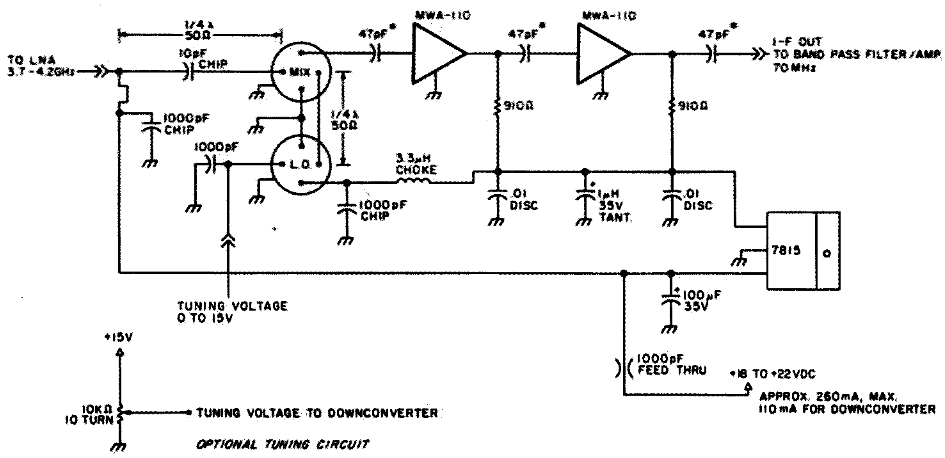

*Fig. 1. Satellite downconverter schematic. * = chip or disc ceramic.*

Circuit Description

Refer to the schematic, Fig. 1, and to the PC-board layout and parts placement overlay for the following discussion. The complete downconverter is constructed on a 2" by 4" teflon PC board, 1/32" thick. Impedance matching is achieved by using microstrip transmission lines. To supply dc power for the LNA, a dc block is incorporated on the board. This lets the coax from the LNA supply the LNA's required operating power. The dc feed is accomplished very simply by supplying the +18 to +22 volts that powers the downconverter to the rf input through an rf choke. The dc side of the choke is bypassed for rf with a 1000-pF chip capacitor.

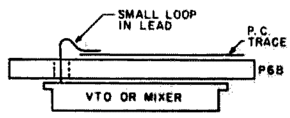

Fig. 2. Mixer and vto lead bending and soldering instructions.

The 4-GHz input is ac-coupled through a 10-pF chip cacpacitor to a ¼-wave, 50-Ohm transmission line going to the rf port of the mixer. Local oscillator injection to the mixer is also via a ¼-wave, 50-Ohm transmission line for impedance matching. The i-f port of the mixer is ac-coupled to the first MWA-110 for approximately 14 dB of i-f gain, and then to the second MWA-110 for an additional 14 dB of i-f gain. The output of the downconverter feeds the 70-MHz bandpass filter in our home-brew receiver.

Construction

The first step in constructing the downconverter is to drill the 2" by 4" minibox using the drilling guide shown in Fig. 3. The bare PC board can also be used as a drilling template. Use ½" standoffs to mount the board in the box. We used a type-N connector for the rf connection from the LNA. You also can use an SMA connector in place of the type-N with equally good results. BNC or type-F connectors are adequate for the LO tuning voltage and 70-MHz i-f out.

Next, install the two MWA-110 i-f amplifier ICs on the printed-circuit board. Be sure that they are flat against the ground-plane side of the PC board. Solder the tabs on the 110s to the ground plane, cut the leads to 1/8", bend them flat against the PC board, and solder. Now install the mixer and local-oscillator modules. Be sure that the ground pins are in the correct holes on the PC board, or you will wind up with some expensive but useless trinkets.

Caution: Do not cut the pins on the modules. Bend the pins in a small loop over to the PC board and solder. (See Fig. 2.) Solder the pins to the PC-board trace using as little solder as possible. Install and solder the six feedthrough jumpers, using pieces of cut-off resistor leads, and solder on both sides of the board. Now install the rest of the components, except for the 3.3-uH choke.

After construction is complete, check for solder bridges. Temporarily connect the +18 to +22 volts to the dc input of the voltage regulator. Measure the output voltage to see that the voltage regulator is working. The output should be +15 volts. Measure the voltage drop across the 910-Ohm resistors; it should be 2 to 3 volts. If it's not within the range, then you probably have a bad MWA-110 (we have found several). If the voltage drop measures OK, remove power and discharge the electrolytic capacitors. Now install the 3.3-uH choke. This completes the PC-board assembly. The next step is to install it in the minibox.

Depending upon the type of rf connector used, N or SMA, it may be necessary to solder extension leads to the PC-board pads to reach the connectors. Be sure that when the extension leads go through the PC board they do not short out to the ground-plane side. Solder the four leads (three from the connectors and one from the 1000-pF feedthrough capacitor) to the appropriate points on the PC board as shown by the parts overlay.

> **PC BOARDS**
>
> Etched and drilled teflon printed circuit boards for the downconverter are available for $27.00, plus $1.50 for handling and postage, from Martcomm, Inc., PO Box 74, Mobile AL 36601.

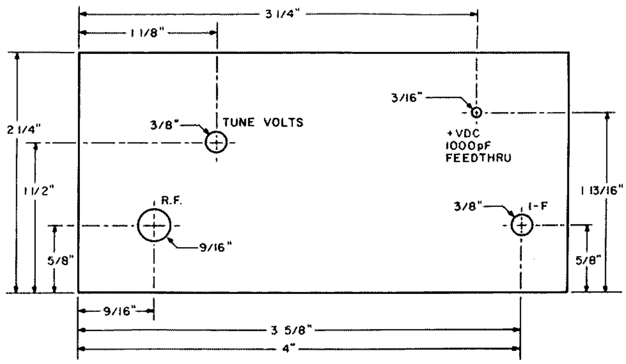

Fig. 3. Drilling template for 2" by 4" minibox.

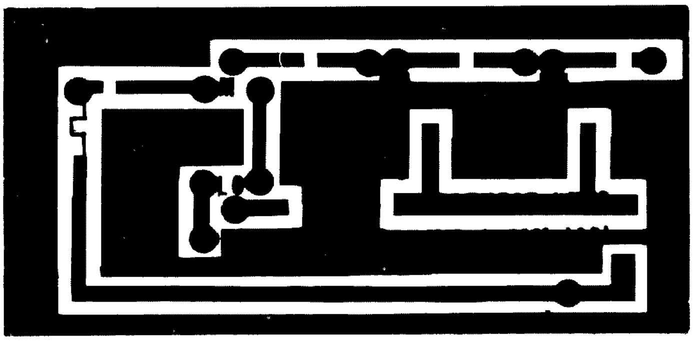
Fig. 4(a). Foil side view of board.

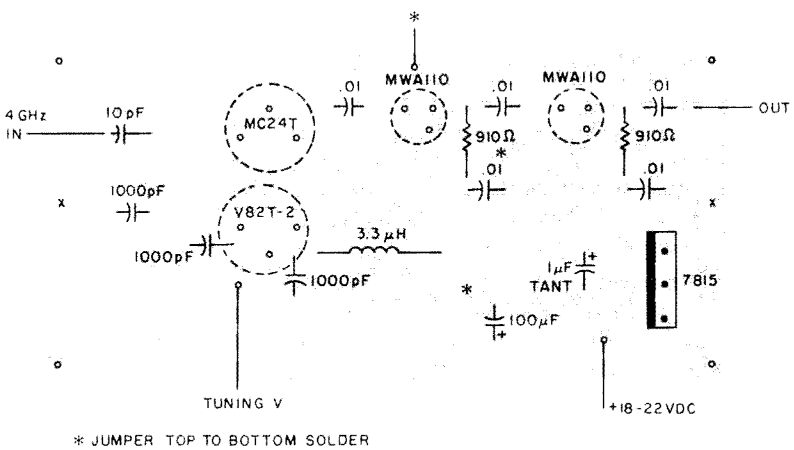

Fig. 4(b). Parts placement, foil side view.

Checkout

If your antenna and LNA have been completed, you will be able to check your system through the i-f output of the downconverter. With your LNA and downconverter connected to your antenna, apply power. Connect the output of the downconverter to the antenna terminals of a *conventional* color-TV receiver, with the TV tuned to any unused low channel between 2 and 5. If possible, connect a voltmeter to the agc line on the TV set tuner. The agc voltage can give a very useful indication of proper aiming and adjustment of your satellite TV antenna.

With the optional tuning circuit (Fig. 1) connected to the tuning voltage input of the downconverter, transponder 1 tuning voltage will be about 4 volts. To tune transponder 24, you will need about 12 volts. You should be able to tune in most transponders over the 4-to-12-volt range. Also, you should get an indication of video on the color-TV set when a transponder is tuned in. The video will be of very poor quality since the satellite signal is frequency modulated while the conventional terrestrial TV signal is amplitude modulated. You should still be able to recognize the pictures, however. Sync will be very critical and you probably won't be able to sync on all transponders.

That's it! The rest of your TVRO receiver is cheap and simple, as we will show you in future articles. ■

Parts List

Quantity	Description
1	MC24T mixer module (Magnum Microwave)
1	V82T-2 local oscillator module (Magnum Microwave)
1	10-pF chip capacitor
2	1000-pF chip capacitors
3	50-pF disc ceramic capacitors
2	.01 disc ceramic capacitors
1	1-uF, 35-V tantalum capacitor
1	100-uF, 35-V electrolytic capacitor
1	1000-pF feedthrough capacitor (mounted on minibox)
2	910-Ohm, ½-Watt resistors
1	10k-Ohm, 10-turn pot (optional tuning circuit)
1	3.3-uH choke
2	MWA-110 ICs
1	7815 voltage regulator
1	2" by 4" minibox
	Rf connectors, hardware, etc.

The Magnum Microwave MC24T mixer module, the V82T-2 local oscillator module, the MWA-110s, chip capacitors, and the rf connectors are available from Cliff Jones at Alaska Microwave, 4335 East Fifth Street, Anchorage AK 99504, (907)-338-0340, a regular *73 Magazine* advertiser.

Acknowledgments

We would like to thank the staff at Magnum Microwave for running tests on our prototype downconverter. The measured down-conversion gain was 21 dB with 4-GHz input. At −20-dBm and −40-dBm input, the second harmonic of the 70-MHz i-f was −25 dBc and −50 dBc, respectively. Magnum also confirmed our discovery that the MWA-110 will oscillate if not properly grounded. The above specs were furnished to us by Magnum Microwave and are quoted with their permission.

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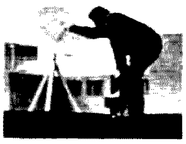

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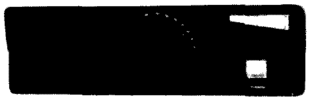

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SOCIAL EVENTS

PHILADELPHIA PA
MAR 7

The Penn Wireless Association, Inc., will hold its Tradefest '82 on Sunday, March 7, 1982, at the National Guard Armory, Southampton Road and Roosevelt Boulevard (Rte 1), 2 miles south of exit 28 on the Pennsylvania Turnpike, Philadelphia PA. General admission is $3.00 and a 6' × 8' seller's space is $5.00 (bring table) with an additional $3.00 for a power connection (limited number). There will be prizes, displays, refreshments, rest areas, and surprises. Talk-in on 146.115/.715 and .52. For additional information, contact Mark J. Pierson KB3NE, PO Box 734, Langhorne PA 19047.

EAST HARTFORD CT
MAR 11

The Hartford County Amateur Radio Association will hold its annual auction of used equipment on March 11, 1982, at 7:30 pm at the Veterans Memorial, Sunset Ridge Road, East Hartford CT. Refreshments will be served.

MERRIMACK NH
MAR 13

The Interstate Repeater Society, Inc., will hold its annual hamfest and flea market on Saturday, March 13, 1982, from 9:00 am until 4:00 pm at the Merrimack Hilton Hotel, Merrimack NH. Admission is $1.00 and tables are $10.00. Features will include commercial vendors, prizes during the day, and a dinner dance with live music and entertainment. Talk-in on 146.25/.85 and 146.52. For further information, contact Ken Soares N1BAD at PO Box 94, Nashua NH 03061 or on .25/.85.

MIDLAND TX
MAR 13-14

The Midland Amateur Radio Club will hold its annual swapfest on Saturday, March 13, 1982, from 8:00 am until 6:00 pm, and on Sunday, March 14, from 8:00 am until 3:00 pm, at the Midland County Exhibit Building east of Midland TX on the north side of Highway 80. Registration is $5.00 in advance or $6.00 at the door. An additional $3.00 will be charged for each table. There will be door prizes. Talk-in on 146.16/146.76 and 146.01/146.61. For more information, write the Midland Amateur Radio Club, Box 4401, Midland TX 79704.

LAFAYETTE LA
MAR 13-14

The Acadiana Amateur Radio Association will sponsor the

Continued on page 104

See List of Advertisers on page 130

TVRO Q & A

—advice from WBØPOP

Ken Rae WBØPOP
737 South Clarkson
Denver CO 80906

I want to build a TVRO. What is the first step?

Most people get started by acquiring an antenna. You can buy a commercial antenna or you can build your own dish. If you buy, plan on spending $1000 or more. Building your own is cheaper, but it can take considerable time and energy. Plans are available from several sources, but don't expect to get a world of information from a $10 brochure. It takes a lot of research and study since there is no one source for all the information you need.

How can I get a picture for the lowest possible cost?

If you are not concerned about the quality of the picture, then all you'll need is an antenna, a low-noise amplifier (LNA), a mixer, and a conventional television receiver. With just these components you'll be able to say that "I received satellite TV." Since the TV receiver acts as a slope detector, the video will not be clear or stable, but this low-cost approach will get you started.

What about kits?

Kits are available for each part of an Earth terminal, but the best way to describe this part of the industry is "buyer beware." Try to find someone who has successfully completed the kit before you take the plunge.

What size dish do I need?

The size of antenna depends on the quality of the LNA, the strength of the satellite "footprint" in your location, and the desired signal-to-noise ratio. You can get watchable video from an eight-foot dish, but the 10-foot dish seems to be the industry standard for home TVROs.

Why are 10-foot antennas so popular?

A 10-foot dish is usually the minimum size that is practical for receiving good quality pictures in most locations in the US. You can use a smaller antenna, but the need for a better quality LNA may boost the overall cost higher than what you would spend for a 10-foot system.

What is the smallest dish I could use?

If you are willing to settle for audio only, a four-foot diameter antenna supposedly works. A six-foot antenna might give you a faint video image if everything else is perfect.

How much should a 10-foot dish weigh?

At one extreme there is an umbrella-type antenna that weighs only 22 pounds. On the other end of the scale there are heavy-duty antennas that weigh half a ton or more. The average weight of a fiberglass or spun-aluminum dish is in the neighborhood of 200 pounds.

Should I get a spherical or parabolic antenna?

The parabolic is my choice because it's versatile. You can sweep the antenna across the sky, making it easy to change to a new satellite. The spherical is a good antenna from a construction viewpoint. Unfortunately, changing satellites involves moving the feedhorn, which is usually six to eight feet above the ground.

Someone told me that I should build a spherical dish because it exhibits more gain than a parabolic antenna. Is this true?

The gain of spherical antennas is indeed greater because the dish has a flatter surface. However, the flat curvature means that the spherical will pick up more unwanted noise. The parabolic has slightly less gain but more noise immunity. You must consider both noise and gain characteristics when choosing an antenna.

How can I tell if a dish is a parabolic or spherical?

A parabolic dish will tend to look flatter as your eye moves toward the edge. The spherical antenna has a constant curve, rounded all the way to the rim.

I found a surplus dish. How can I tell if it is too deep or too flat?

You want to check the focal-distance-to-diameter ratio, F/D. You can find the focal point by using the equation $D \times D/(16 \times H)$, where D is the diameter and H is the depth. The F/D should be between 0.35 and 0.55 with 0.4 being about best. Ratios out of this range will not have the optimum noise versus gain characteristics.

I have found a dish but it has some dents and holes. Will that affect the performance?

A 10-foot dish has approximately 78 square feet of reflective surface area, so a few imperfections won't cause a problem. You probably can afford to lose as much as 5% of the surface area.

How smooth does the surface of the dish have to be?

The accuracy of the antenna should be plus or

minus a sixteenth of an inch of the parabolic curve if you expect a reasonable level of gain.

I am trying to choose between buying a 10-foot dish made for TVRO work and a surplus 16-foot antenna. The price is about the same; wouldn't the 16-footer be a better deal?

It depends upon their quality. Often a surplus dish that was not designed for use with 4-GHz signals will be inferior to a smaller, better constructed antenna. Check the surface accuracy of both antennas. Anything more than an average inaccuracy of an eighth of an inch means that gain will be adversely affected. If the big dish meets the requirements for 4-GHz operation, then by all means grab it.

How important is the structural strength of a antenna?

A dish that can stand on its own rim and still hold the parabolic shape within an eighth of an inch is not likely to be harmed by weather. Anything weaker is questionable.

The area I live in has a lot of wind. What can I do to avoid losing my antenna?

To avoid having an airborne dish, I fastened a cable around the rim and attached it to a deadman anchor.

Screen antennas seem easy to build. How large can the holes in the mesh be?

A quarter-inch hole is about the largest gap you can have without an appreciable amount of the signal feeding through. An eighth of an inch is a good choice. Window screen can be used, but it does have a lot of wind resistance.

Is it necessary to solder every joint in a screen reflector?

If the sections of mesh or screen overlap each other by at least one wavelength (approximately three inches), the seams will not cause a dead spot. If there is not enough overlap, there should be some sort of electrical bonding.

What do trees and shrubs do to the satellite TV signal?

Foliage acts as a sponge that absorbs microwave signals, and it generates noise that will be picked up by the antenna. Trees and shrubs have a destructive effect and should be avoided when you choose a site for the antenna.

What effect do rain and snow have?

Precipitation doesn't seem to have much effect on a 4-GHz signal—perhaps half of a dB at most. If the moisture gets inside of the electronics, there can be significant attenuation. Powdered snow can pile up in a dish without causing a problem. But if the snow melts and refreezes, the surface of the dish can be distorted, causing the signal strength to drop. You should keep your antenna clear of ice and snow.

My neighbors complain about the appearance of my TVRO antenna. Can I cover the dish without adversely affecting the signal?

A thin covering of plastic or fiberglass can be used without too much signal attenuation. Avoid a covering made from wood or other material that contains moisture.

Will my dish work inside a barn or garage?

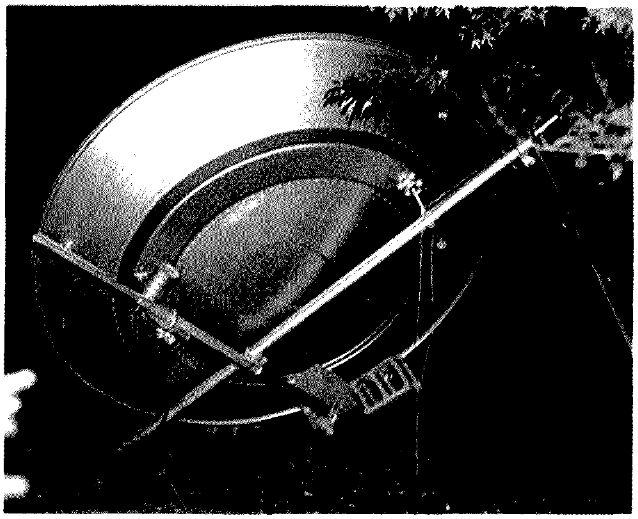
Yes, you can keep the antenna inside. Of course, the building will attenuate the signal. The exact amount of the loss depends on the type of building; it can be anywhere from two to six dB of attenuation.

I bought a used metal dish and want to paint it. Any suggestions?

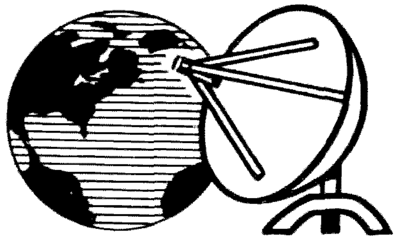
Aluminum antennas can be painted with a good grade of latex house paint intended for house siding. Be sure to use a light color. Painting the dish black will result in the antenna absorbing heat, stressing the dish and changing the shape. The texture of the surface should be dull and flat, not shiny, since we want the light to be diffused instead of reflected towards the LNA. Follow the same guidelines for painting a wooden or fiberglass antenna.

How far above ground should I mount my dish?

The rule of thumb for dish installation suggests that the lowest edge of the dish should be located two or three feet above the ground. Setting the antenna directly on the earth will increase the amount of noise that enters the system.■



I used readily-available materials to build this simple, yet effective, mount for my satellite TV antenna.



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India

Indian Hams Rejoice
—import restrictions lifted

Indian hams have achieved a breakthrough in their efforts to solve their problems of lack of equipment. The manufacture of communications equipment in India is the monopoly of the public sector (government-owned industries), which is itself lagging so much in production that it is unable to fully meet even the needs of the governmental users.

For several years, the Federation of Amateur Radio Societies of India had been making representations to the government, requesting relaxation of import controls without much success. The improvement in the foreign exchange position enabled the government to make concessions to certain users—among them scientists and professionals—who were allowed to import equipment valued at up to 10,000 rupees (about $1200 US) for their personal use. M.V. Chauhan VU2MV, Hon. General Secretary of the Federation, saw an analogy between the scientists and the hams. He convinced the Electronics Commission that the extension of similar privileges to amateurs was the only solution to the equipment problem.

Disaster can sometimes have a beneficial fallout. The communications link set up at Morvi by our hams (led by Saad Ali VU2ST, president of the Federation, Jimmy Mistry VU2IJ, and Vasant Bhat VU2RX) after a bursting dam had killed an estimated 30,000 in the span of a few hours cleared any lurking doubts in the mind of the government about the utility of ham radio to the nation.

Relentless representations to the various ministries by the Hon. General Secretary Chauhan and President Saad Ali finally resulted in the inclusion of radio amateurs in the category of scientists, and they were allowed the privilege of importing, under Open General License, test equipment worth up to 10,000 rupees in a year. There were more representations, and the momentous decision was announced which permitted the import of "amateur radio communications equipment, including kits, accessories (including antenna rotator motors, feedlines, standing wave ratio bridge), instruments, spares, and components" up to 10,000 rupees in a year, without the need for a formal license.

The Federation of Amateur Radio Societies of India is today a tower of strength to the Amateur Radio Service in India. Its QSL bureau handles the bulk of incoming and outgoing cards. *Radio,* the monthly journal of the Federation, edited by M.V. Chauhan VU2MV, is read by virtually every ham and SWL. The ARRL *Handbook* and other books have been imported and sold at a low price. A guide to amateur radio in India by Saad Ali has been published. The Federation's efforts have led to a breakthrough in making equipment available to Indian hams.

The Federation is not resting on its laurels. M.V. Chauhan is continuing his efforts to have the manufacture of ham equipment thrown open to private industry, so that equipment can be made available to the less affluent ham for prices expressed in hundreds of rupees rather than in thousands, which is the case with imported equipment. He believes another breakthrough is on the way, which will help amateur radio in India to become the hobby of the common man and not a monopoly of the affluent. ■

Harry A. Schools KA3B/DA2AL
PSC Box 2713
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Licensing for Americans Overseas

—classes help, but our government doesn't

In an earlier issue of *73 Magazine*, Wayne Green mentioned that he would like to hear what the amateur radio community was doing to get more people into the classrooms and on the air. At first, I thought of sending a letter to *73 Magazine* describing our current situation here in West Germany involving military personnel in regard to licensing classes. After pondering the idea for a few days, I decided that an article would be more appropriate.

The not-yet-licensed American civilian or military person abroad will, in many cases, encounter some problems that are unique, to say the least. But being a ham in the military has many advantages, such as the opportunity to operate from various countries of the world with reciprocal licensing. Unfortunately, getting that US license once an individual has been sent to a far corner of the world is sometimes difficult. But for those who are interested in obtaining their ticket, there is hope. Thanks to a crop of dedicated and hard-working hams scattered throughout worldwide military installations, amateur radio licensing classes are a reality.

Before I tell you about amateur radio classes and the people who teach them, let's take a look at why these individuals who aren't licensed desire their ticket. Actually, their reasons are no different than anyone else's. Basically speaking, they have a genuine interest in amateur radio. However, there are some underlying reasons which motivate these prospective hams.

First of all, it is a fact that a large number of newly licensed hams in the United States were once active on 11 meters. West Germany, like other countries in Western Europe, has a personal communications band on 27 MHz. Quite a few Americans come to Germany with their CB gear only to discover, to their dismay, that it's just as bad or even worse than back home. There are fewer channels, lower allowable output powers, monthly licensing fees, and severe overcrowding on the airwaves. Also, there is a language barrier because many 11-meter operators speak little or no English. It is a very disheartening situation, to say the least. Therefore, they have three options available. One, pack up the radio in its box and place it in the closet; two, stick it out on the band; or three, get an amateur license and talk to the world. I don't have to tell you that many choose option number three.

Secondly, many military members are met with the misfortune of having to serve at remote installations in places that you and I never thought existed. However, someone has to do it. In this case, amateur radio is a tremendous boost for one's morale.

And finally, there are those individuals who want the license only to talk with the family back home. I have run across several people whose parents were licensed but never did force the radio or electronics on them when they were growing up. Now they have the motivation and time they need to get that ticket. Besides saving on phone bills, writing letters, and waiting in line at the local MARS station, getting the license would please the heck out of Mom and Dad.

Although the reasons I have stated for military personnel and their families wanting an amateur license are generalizations, they are real. They are the sparks that ignite the fire . . . motivation is the key.

Once an individual has decided that he would like to pursue amateur radio as a hobby, his next step is to locate a licensed ham in the area for more information. Most larger military installations have active amateur radio clubs, but this is not always the case. Therefore, a check with the local MARS station is a good idea. If there isn't someone working there who is licensed, they will usually refer you to someone who is. What happens next? Well, if the military installa-

tion itself and the surrounding community is saturated with a large number of Americans, chances are that some sort of licensing program exists. For the smaller installations, it's a somewhat different situation. There may be only one or two active hams, but in the spirit of amateur radio, they will undoubtedly be helpful and outgoing. One interesting point I should bring up here is that the *Stars & Stripes* bookstores overseas are usually stocked with the ARRL license manuals, *Radio Amateur's Handbooks*, and the latest copies of *73 Magazine*. Therefore, individualized study, reinforced with the tutoring and supervision of an Elmer, will usually reap good results. Individual study of a subject which is diversified and foreign to most people, such as amateur radio, is a major undertaking that requires considerable motivation and determination when no other help is available.

The military life-style can be more demanding than its civilian counterpart, and because of this, not every ham has the time for the individualized tutoring of an aspiring student. It's a sad fact of life. However, there are some hams who care enough to make time and are doing a great job of getting the newcomers started. What follows is one of many such success stories that are taking place in West Germany where an overwhelming number of American military and civilian personnel and their families live and work.

A Ham Who Cares

Hahn Air Base is located about 50 miles west of Wiesbaden. I arrived there on orders from Uncle Sam back in March of 1979. Before I even processed into my squadron, I dropped by the MARS station in hopes of locating another ham. The military operator on duty there directed me to Steve Hutchins, who was acting as a contact point for the hams. Steve was one of those individuals like myself who first started out with CB radio. He was first licensed in 1977 as a Novice, WD6BKA. Shortly thereafter, Steve upgraded to General and received the reciprocal call, DA2HS. During that first meeting we had together, he gave me the full rundown. There were 10 hams stationed at the base, but no formal club to speak of. One of those hams, Floyd Bixler WD8DUP/DA1VF, was teaching an amateur code and theory class every Sunday for several of the personnel stationed here. Floyd had to cancel his classes due to other commitments, but only after everyone had successfully passed the Novice examinations.

At this point, Steve took over the reins and put the word out through various channels that an amateur radio code and theory class would be starting. Steve was well qualified to teach due to his excellent working knowledge of electronics, something he never learned in school, but on his own in his spare time. Assisting Steve in the classroom was Bob Haggart, who was very knowledgeable in the radio and TV repair field and at that time was a Novice with the call KA3CSE. Steve also enlisted my help to teach propagation and regulations and substitute for him when it was impossible for him to be at class. Steve carefully planned the learning sessions so that the conclusion of the three-month class would occur just when the FCC was due to arrive.

The FCC travels to West Germany twice a year in order for American military and civilians to test for their amateur and commercial radio licenses. Steve's plan was to get everyone a Novice ticket at the end of the first month; then he could teach them the additional theory needed to pass the Technician exam.

A Novice license is of little or no value in some countries under current reciprocal agreements, but since Germany recognizes the interim permit issued by the FCC as being a valid license, when a Novice ham with a callsign upgrades, he is immediately eligible to apply for a reciprocal German license without waiting 6 to 8 weeks for a callsign and license from the FCC. But the pressure is really on to pass the exams, because if an individual fails this attempt at the examination, it is six long months before there is another chance to test. This is one of those unique problems that the American citizen abroad encounters. Many students of amateur radio lose their interest and bail out because of this unfortunate situation. More on this later.

Steve's first class had its share of students who dropped out for various reasons. Those who hung in there and worked hard upgraded to Technician or General. This is the only reward that a teacher can receive, and the majority of his students rewarded Steve generously.

An interesting point to bring up here is that the student of amateur radio in Germany has it a little bit rougher than the student back home. The reason is that everyone's aim is to achieve at least the Technician-class license because it gives more operating freedom under the German reciprocal agreement. Therefore, not only does the student have to be familiar with the US regulations for the test, but also with the German regulations if a reciprocal license is desired. When it comes to frequency allocations and authorized emissions, things can get very confusing, even for the old-timer.

Steve has no magic formula for teaching or recruiting people into amateur radio. Patience and determination are the virtues that produce results. Steve is not a one-man show or Super Elmer. He regularly invites other hams in the area to help him teach classes. Their experience in the areas of ham radio in which they specialize is a great asset in helping the students learn and hold their interest.

Along with teaching code and theory, Steve has been putting much time and effort into the Air Force MARS program, which provides valuable training for new licensees. How he finds time to enjoy his rag-chewing, DXing, building, and troubleshooting is beyond me. Besides all of this, during 1980 he still managed to obtain his amateur Extra license (KN6G), his Second Class Radiotelephone license, and another stripe to wear on his sleeve. What more is there to say?

What Determines Success

You are probably asking yourselves, what's the big deal about four people getting their Novice tickets? Actually, I am trying to make a point. The dictionary defines success as "a degree or measure of succeeding; a favorable termination of a venture." For some strange reason, many amateur radio classes never materialize because someone determines that not enough people are interested. Baloney! The success of a class or study group is not dependent on its size but on the basis that something constructive has been accomplished. An amateur radio class does not have to be congested with so many bodies that a "Standing Room Only" sign is hanging

at the door. This is utter nonsense! Many are denied entry into our great hobby due to such primitive thinking. As I suggested before, individual study should be avoided where possible. Classroom study with supplemental home study is the way it should be done. If every radio club across America started some sort of training program, no matter how big or how small, we would be in a lot better shape.

All radio clubs across the country should get into gear as quickly as possible and drum up constructive and educational amateur radio classes. Look where it has taken the Japanese! It certainly hasn't hurt them. Here in West Germany, hams serving with the Air Force are doing their part. Classes are regularly held at Ramstein, Sembach, Hahn, Zweibrucken, Rhein Main, and in the Spangdahlem and Bitburg areas. I am not familiar with what the amateurs in the Army in West Germany are doing regarding amateur radio classes in their communities, but judging from their numbers, they must also be active with classes. Perhaps someone would like to write a follow-up and let us know what they are doing also.

FCC Policies: Hurting the Growth of Amateur Radio

As I mentioned earlier, the FCC travels twice a year to Germany, once in the spring and once in the fall. This certainly is not often enough! Now there is talk of no visits by FCC examiners due to the cost of travel, etc. They have got to be kidding! The US government gives millions of dollars away to countries who have stabbed us in the back and continue to do so, yet they can't seem to allot a few thousand dollars a year for examiners to test Americans abroad. The U.S. military and civilians who are serving overseas defending our great country deserve some consideration. Perhaps the FCC could institute some type of system similar to the Conditional licensing program that existed some years back. Or else they should consider traveling overseas more often. Amateur radio operators perform a public service with emergency communications and enhance international goodwill. If these policies remain in effect an extended period of time, the growth of amateur radio will resemble a centipede with sore feet . . . yes, that slow!

It would be much more comforting to know that the FCC was working with us and not against us. But, like other government agencies, the FCC is a strange animal with its own behavioral patterns. Until we find out what their last minute decision-making will bring forth, we are gritting our teeth and rolling with the punches.

This article was prepared in order to illustrate the present situation concerning Americans abroad. Amateur radio is sought as a hobby and/or morale booster by many because of those unique motivation factors. Secondly, licensing classes are reality, thanks to those who care enough to give of their time. And, to repeat what was written earlier, the success of a class or study group is not dependent on its size but on the basis that something constructive is to be accomplished. Think about it. And finally, current FCC policies are hurting the growth of amateur radio with no reversing trend in sight . . . that's the bottom line. ■

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The Masher

—son of The Amazing Audio Elixir

When I first read the article on which this article is based, "The Amazing Audio Elixir," *73*, September, 1979, I really didn't read it at all. It looked a little hokey. Words like "amazing" and "cure-all" turn me off, especially when they're used to describe an audio limiter, processor, compressor, etc. I flipped on through the magazine to find something more interesting and useful. It wasn't until several months later, when a friend asked me to help him check out a compressor he had just built, that I gave any serious attention to N6WA's article and circuit.

My friend, John W8SSM, had built The Amazing Audio Elixir and he was anxious to receive some on-the-air reports. John was using the Elixir with his Kenwood T-599D and Heath SB-221. We were on 40 meters and the band was in good shape. I would be able to give him an accurate and, I expected, negative report. It had long been my belief that unless you wanted to spend a tidy sum for a store-bought rf speech processor like the Vomax, all that an external audio limiter, processor, compressor, etc., would do would be to junk-up an otherwise clean and intelligible signal. Got the picture?

John started the tests: "Compressor on: 1, 2, 3, 4, 5 . . . Compressor off: 1, 2, 3, 4, 5 . . ." And on and on. I couldn't believe what I was hearing! The blooming thing actually *improved* his signal! It reduced the peak-to-average ratio of his audio, and it seemed to give his audio more brilliance; that is, it attenuated many of the lows, which only consume power without adding to intelligibility, and it enhanced the mid-range and highs. It did this *without causing undue distortion and without raising background noises noticeably.* John turned on The Amazing Audio Elixir, and he turned me on to it. I liked what I heard, and I decided that I should have one.

It should be noted that the circuit diagram appearing in the original *73* article contained one error. It showed the gate of Q1 and capacitor C4 connected to the junction between R1 and R2. This should not be, and the corrected diagram is shown in Fig. 1. This is the circuit that John used and that worked so well as is.

But few things are so good that they can't be improved upon. After all, the original Elixir was described as a multi-purpose device—for tape recorders, computers, phone patches, repeaters, etc. N6WA mentioned only in passing that it might be used as a transmitter speech processor/compressor.

So, I set out to optimize the Elixir for use as a

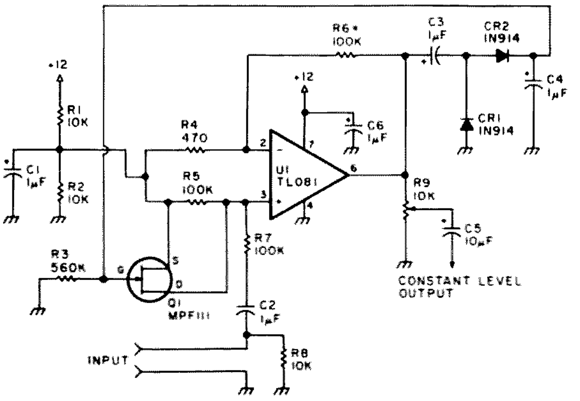

Fig. 1. Original circuit of the Amazing Audio Elixir (with correction).

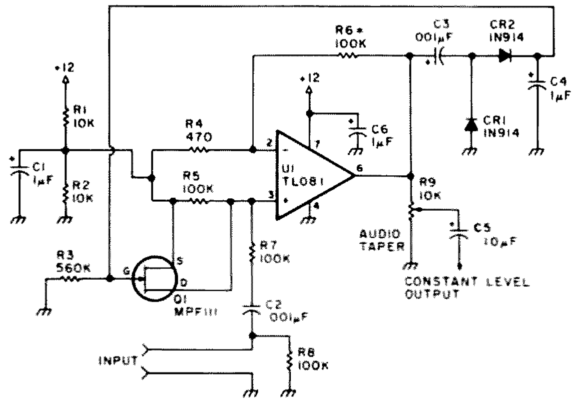

Fig. 2. The Masher circuit, fine-tuned for speech processing tasks.

transmitter speech processor/compressor. By the way, John found it clumsy to refer to the gadget by its given name, The Amazing Audio Elixir, or by its generic name, a transmitter processor/compressor, so he tagged it The Masher. It does "mash" the audio peaks down closer to the average modulation level—a descriptive name, I think, and a whole lot less clumsy to use.

Fortunately, N6WA makes available a neat 2" × 2" printed circuit board for $3.50 ppd. I ordered one, and when it came I was pleased to find that an accompanying data sheet gave significant technical information and specifications, which I found useful in my subsequent modifications. For example, the original circuit provides an af range of 100 Hz to 25 kHz to the 2-dB points. Ham transmitters don't need that extremely low frequency response. The data also showed that the input impedance was 10k Ohms. My microphones are high impedance. These considerations prompted the modifications to change the Elixir into the Masher. The modified circuit is shown in Fig. 2.

Experiments and on-the-air tests indicate that changing R8 from 10k to at least 47k not only raises the input impedance, but also allows a high-impedance microphone to retain its original characteristics. Values from 47k to as high as 1 meg were used without noticeable difference. I settled on 100k.

C2 and C3 were changed from their original values to 0.001 μF, providing a low-frequency roll-off at about 400 Hz. R3 was changed to 470k (Radio Shack does not stock 560k) with no effect on performance. And, finally, I used a regular 1/2-Watt audio-taper potentiometer for R9 and mounted it on the front panel of a small minibox. The multi-turn, board-mounted trimpot originally specified made adjustment of the output level much too difficult.

Construction is simplicity itself, whether you use N6WA's PCB (that makes it really simple) or perfboard. The hardest part for me was drilling the holes in the minibox for the switch, potentiometer, microphone, and power connectors—and that was easy. I should caution you, however, to be careful in your selection of cable to be used between the microphone and the Masher and between the Masher and your transmitter, especially if you use a high-impedance microphone. Use a shielded cable, but *do not* use the type that has the audio *and* PTT wires inside the shield. Only the audio wire should be inside the shield, as the PTT wire may carry hum and rf to the sensitive audio stages. I recommend Belden No. 8734 (straight) and Belden No. 8497 (coiled) for this purpose.

Testing and adjusting the Masher should present no great problem, especially if you have a cooperative friend with a good ear for audio. With the Masher switched out of the circuit, adjust your transmitter microphone gain as usual, for an alc indication of one-half to two-thirds of the alc range while close-talking the microphone at one to two inches. Set the Masher output level control at minimum, switch the Masher in, and while continuing to talk in a normal voice slowly increase the Masher output level until the alc meter *just begins to flicker*. In most cases, further adjustment will not be necessary. By no means should you try to kick up the alc meter as high with the Masher as you do without it. If you do, your friend out there, listening with the good ear, will probably tell you that your audio doesn't sound very good and that the background noise is too high.

A final word. I didn't have any particular problem finding suitable parts or substitutions for the MPF111 or the TL081—lucky, I guess. But you may save yourself a lot of time by ordering them from N6WA (C. W. Electronics, Box 8306, Van Nuys CA 91409). The PCB is $3.50, the MPF111 and TL081 are $2.00, and a complete kit of parts is $14.95.

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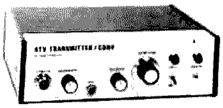

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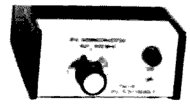

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Parts List

Designation	Description	Qty.
U1	TL081 BIFET op amp	1
Q1	MPF111 FET	1
CR1, CR2	1N914 signal diode	2
R4	470-Ohm, ¼-Watt, 5% resistor	1
R1, R2	10k, ¼-Watt, 5% resistor	3
R5, R6*, R7, R8	100k, ¼-Watt, 5% resistor	3
R3	560k, ¼-Watt, 5% resistor	1
R9	10k pot, audio taper	1
C2, C3	.001-uF capacitor	1
C1, C4, C6	1-uF electrolytic capacitor	4
C5	10-uF electrolytic capacitor	1
	PCB	1

*R6 is a feedback resistor that determines the gain level for the operational amplifier chip. If the mike has a particularly low output level, it may be necessary to increase the gain by making R6 as large as 150k Ohms.

See List of Advertisers on page 130

Innovation or Consternation?

—recent patents dealing with radio

Keith Greiner AK0Q
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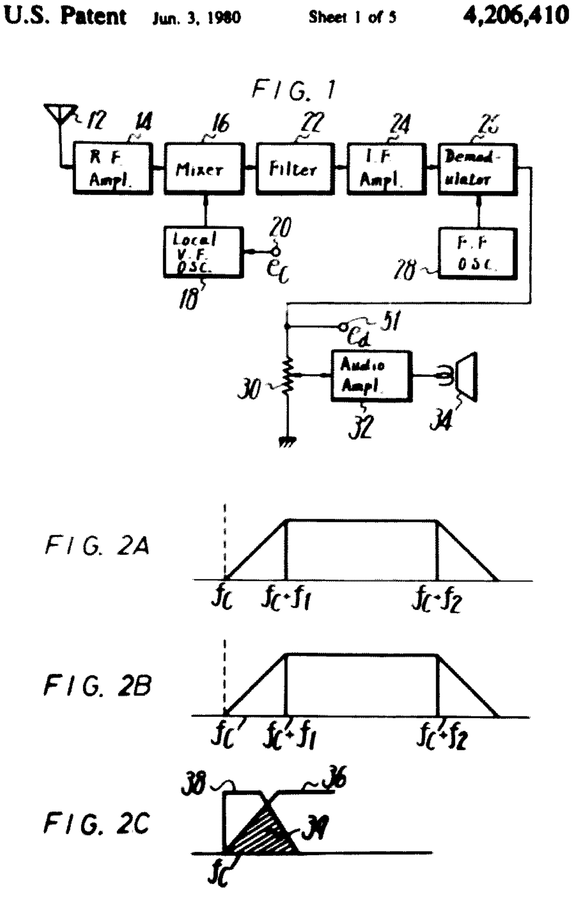


Fig. 1. Automatic frequency control system.

There is an old saying which says that in the life of every person there is one good book. So it is with inventions and amateur radio operators. There is at least one good patentable idea in every good ham operator. What about that little change you made to your antenna, or that FET you stuck in your FT-101?

It is entirely possible that if you wanted to spend the time and money you could discover that your idea is patentable as a new and unique device. As such, it could put your name on the list of over four million pa-

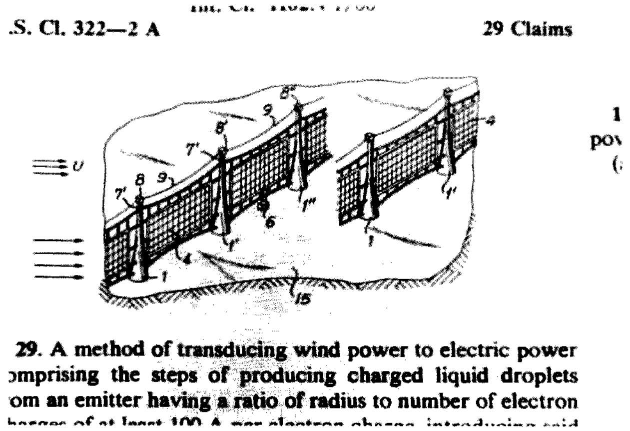
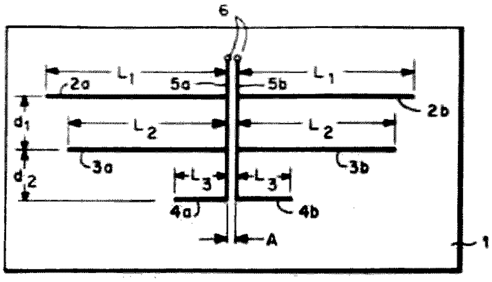


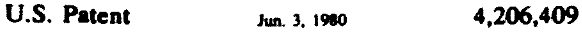
Photo A. Wind to water to Watts?

4,205,317
BROADBAND MINIATURE ANTENNA
ıul T. K. Young, Westwood, Mass., assignor to Louis Orenbuch, Weymouth, Mass.
Filed Dec. 21, 1978, Ser. No. 971,652
Int. Cl.[2] H01Q *21/12, 9/44*
S. Cl. 343—720 4 Claims



1. A broadband antenna comprising
(1) a pair of parallel closely spaced elongate central conductors, each of said central conductors being connected at one end to antenna output terminal means,
(2) a plurality of pairs of dipole elements, the two elements of each pair being equal in length, the elements of each pair being disposed symmetrically on opposite sides of said closely spaced central conductors and extending outwardly therefrom, each element having its inner end connected to the adjacent one of the pair of closely spaced

Photo B. Broadband miniature antenna.



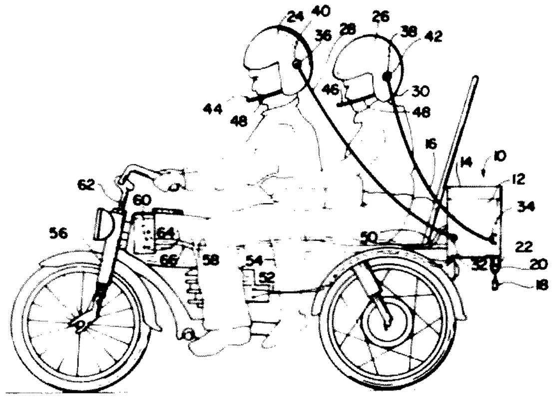


FIG. 1

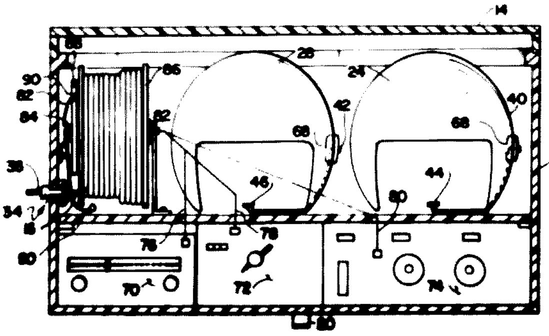


FIG. 2

Fig. 2. Helmet-to-helmet communications.

tents by creative people from all over the world. The list is a giant conglomeration of creativity with ideas from the truly unique to the absolutely absurd . . . from the extremely useful million-dollar money-makers to some which are obviously million-dollar boondoggles.

But for people who are constantly wondering "what makes it tick," finding out how others made it tick can be a fascinating pastime. A perfect source for details of these new ideas is the illustrated weekly publication of the US Patent Office, the *Patent Office Gazette*. The publication is usually about an inch thick and contains hundreds of interesting ideas patented during the previous week.

A subscription to the *Gazette* is not inexpensive; it runs about $300 per year. But for purists, I can imagine that curling up with a copy of the *Gazette* at night could be just as interesting as a Nancy Drew mystery is to a junior high school girl.

Unfortunately, the Patent Office doesn't publish information about inventors or their hobbies, so it is impossible to determine how many of them are amateur radio operators. However, it is easy to surmise that many of the ideas might be the direct result of a night of DX-chasing on twenty meters.

Patents are also a way to see the direction that our technology is taking. In fact, there is a section of the Patent Office called the Office of Technology Assessment and Forecast. Some of the basic changes are obvious. For example, it wasn't very long ago that parts used in patents included tubes, mechanical relays, and switches. Now they include many block diagrams showing the flow of logic and processing used in the invention.

Following are some summaries of inventions which have been patented recently.

4,206,410
Automatic Frequency Control System for Single-Sideband Signal Receiver

This invention (Fig. 1) was patented by two Japanese men, Hideo Ito Sagamihara and Haruo Hiki. It could be perfect for locking your receiver to the transmitter of your friend on the other end. With it, you would never need to touch the dial for perfect reception once you've established contact.

The invention works in quite a simple manner. The received single-sideband signal is passed through a low-frequency audio filter. The low-frequency signal has been modulated at the transmitter with a signal which your receiver uses to keep your receiver on exactly the same frequency as the transmitter.

How ingenious! Why didn't I think of that?

To imagine the most absurd possibilities, if your friend's transmitter were a bit unstable, the two of you could go floating along together all across the 80-meter band. On the other hand, given good engineering practice, this device

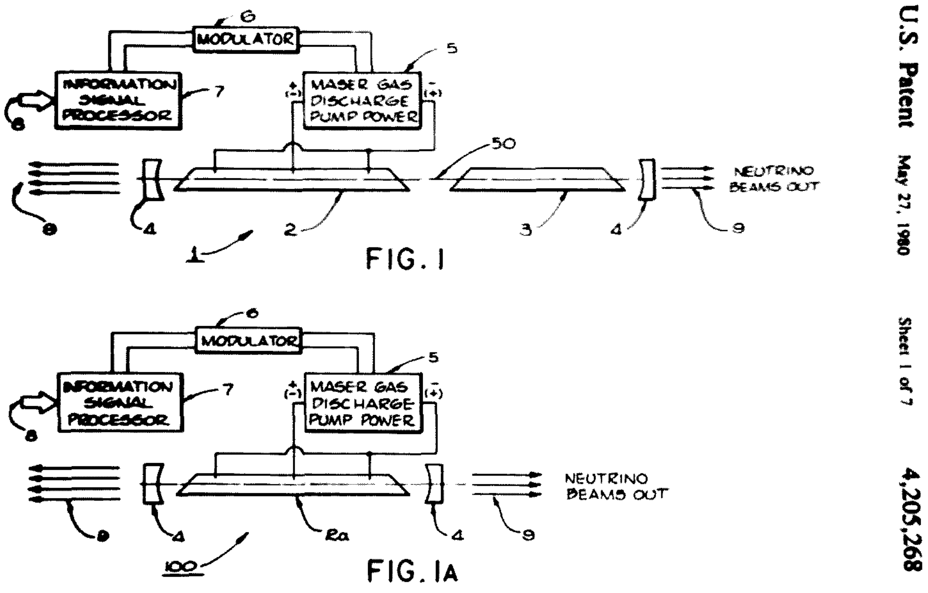


Fig. 3. Intelligence-modulated neutrinos.

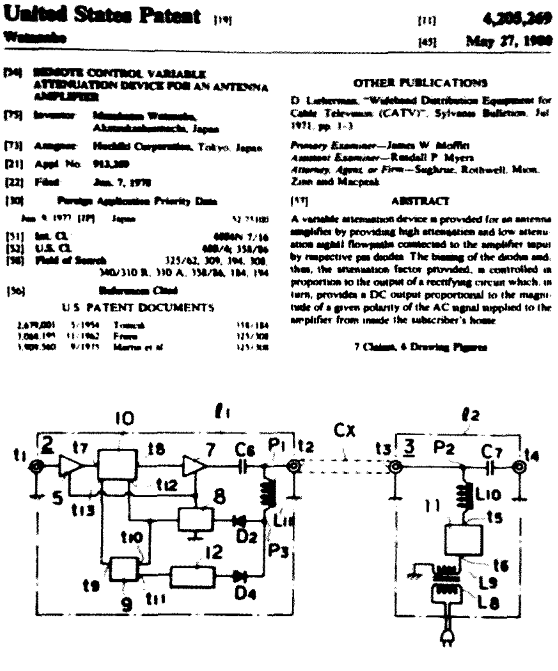


Fig. 4. A device for an antenna amplifier.

could appear in a future generation of improved transceivers and be heralded as a useful innovation for the industry.

Look for this invention to appear first in some piece of Sony equipment. The two inventors have assigned their patent to that company.

4,206,409
Motor Vehicle Communication Apparatus

This novel device by Samuel A. McKinney of Pickering, Canada, could be just the thing you need for mobiling from your Honda. See Fig. 2.

It is made up of two or more helmets, containing microphones and earphones. The helmets are connected to a receiver, an amplifier, and a control box. Now, when you're seeing the world on your cycle, you can listen to some nice music, talk on the repeaters, and even hold a decent conversation with your friend on the back.

I can imagine using the helmet and microphone combination in my car so that my wife and I can communicate while the children yell to their hearts' content in the back seat.

4,206,396
Charged Aerosol Generator With Uni-Electrode Source

Could this be the answer to portable power at your campsight? (See Photo A.) Would it help you chalk up extra points on Field Day? Alvin Marks of Whiteside, New York, may think so.

Marks says that you can change wind power into electric power by producing charged liquid droplets, putting the droplets into a windstream, and discharging them through a load and a grounded electrode.

No doubt, bright ideas like this may one day solve our energy problems. For this one, I surmise that you'll need to charge batteries or find a place with a steady wind. Now, with my ingenuity I'd probably just hook it up to a big fan.

4,205,268
Neutrino Communication Arrangement

Could we some day have ham radio communications on the Neutrino Bands? Neutrinos are neutrally charged particles found in atoms which have a mass of nearly nothing.

Josef W. Erkens, of Pacific Palisades, California, theorizes that by producing a stream of neutrinos, then modulating that stream with intelligence, you can transmit that intelligence to wherever the neutrinos go. Erkens also has patented the idea of a receiver for this system. (See Fig. 3.)

4,205,269
Remote-Control Variable-Attenuation Device for An Antenna Amplifier

This little device could be perfect for that preamp on your antenna (Fig. 4). In essence, the inventor, Masakatsu Watanabe, sends an ac signal from the control box to the preamp along the transmission line. Two diode circuits at the control box allow him to change the amplitude of one-half cycle of the ac. By comparing the difference in amplitude of the two ac half-cycles, the preamp circuit can determine how much to attenuate the output signal from the preamp. The current from one of the half-cycle signals is also used to power the preamp at the antenna.

I see this as an excellent innovation in the field, and one which may soon appear on many antenna circuits. The patent, number 4,205,269, has been assigned by the inventor to

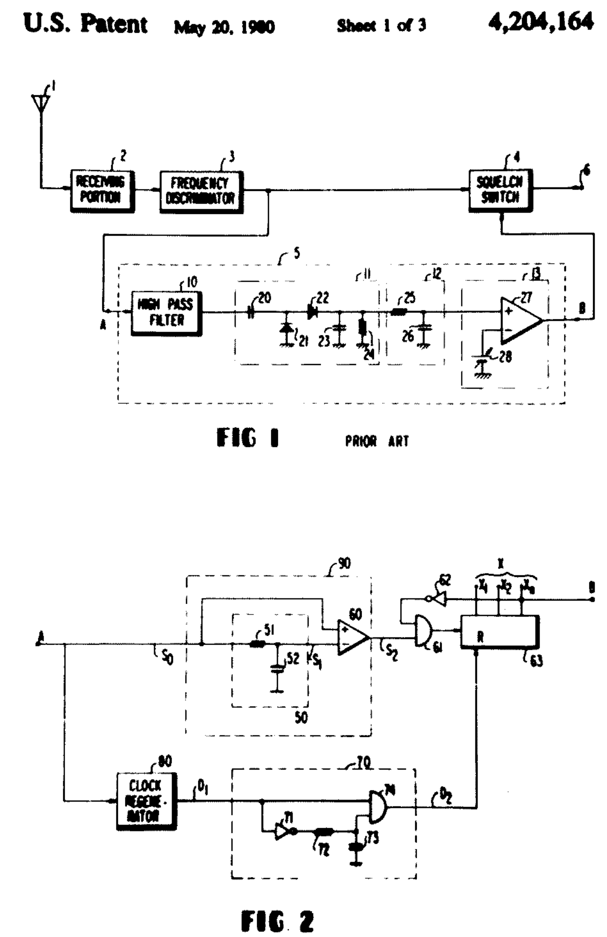


Fig. 5. Taking a noise pulse.

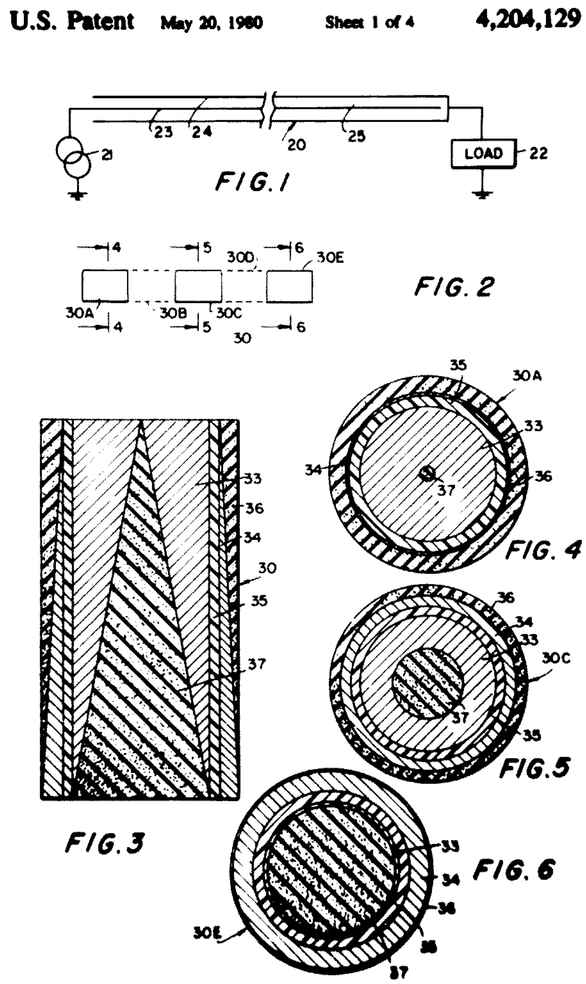


Fig. 6. Capacitance-compensated cable.

the Hochiki Corporation of Tokyo.

4,205,317
Broadband Miniature Antenna

This interesting antenna, shown in Photo B, is made of three dipoles which are spaced apart from each other by somewhere between a half- and a quarter-wavelength of the highest frequency to be used.

The longest dipole pair is approximately one eighth of the wavelength of the lowest frequency to be used, while the shortest dipole is roughly a third of a quarter wavelength of the highest frequency to be used. The middle length dipole is, according to the inventor, Paul Young, of Westwood, Massachusetts, "some intermediate frequency in the broadband."

4,204,164
Noise-Detector Circuit

Having trouble detecting noise lately? Here is a circuit by a Japanese inventor which is designed to do the trick for you—see Fig. 5.

The circuit, which has been assigned to the Nippon Electric Company, is described as consisting of a first circuit for slightly delaying a received signal which contains noise. The output of the first circuit is then fed into a second circuit which converts the delayed signal into a number of pulses. The rate of pulses per minute is directly dependent on the level of the noise being detected. By counting the number of pulses, you know the noise level.

Although it sounds simple enough, I am sure that the actual details, which may be found in the original patent documents, are anything but simple.

4,204,213
Flexible Dipole Antenna

I can just imagine this dipole antenna made of a bright yellow ribbon-like material, and wrapped around an old oak tree or perhaps a small house. It may be just the thing you'll need to toss into a trunk while preparing for your next trip. (See Photo C.)

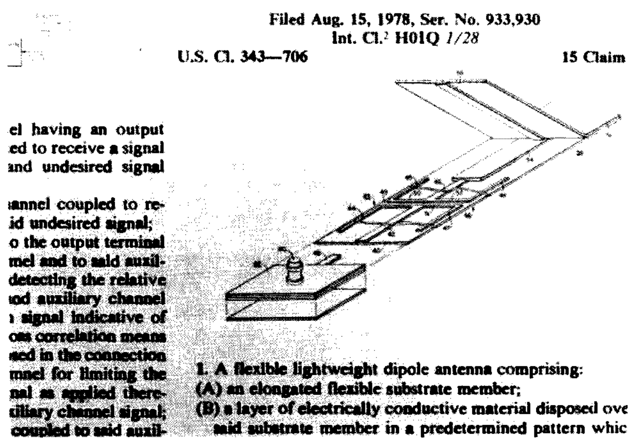
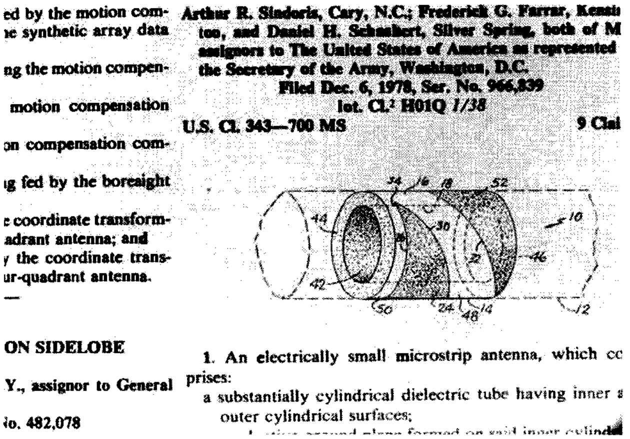


Photo C. Can you Mobius-twist it?


ed by the motion com- / ›e synthetic array data / ng the motion compen- / motion compensation / on compensation com- / ıg fed by the boresight / c coordinate transform- / adrant antenna; and / y the coordinate trans- / ur-quadrant antenna.

ON SIDELOBE

Y., assignor to General

ło. 482,078

Arthur R. Sindoris, Cary, N.C.; Frederick G. Farrar, Kensington, and Daniel H. Schaubert, Silver Spring, both of M assignors to The United States of America as represented the Secretary of the Army, Washington, D.C.

Filed Dec. 6, 1978, Ser. No. 966,839

Int. Cl.[3] H01Q 1/38

U.S. Cl. 343—700 MS 9 Clai

1. An electrically small microstrip antenna, which co prises:

a substantially cylindrical dielectric tube having inner a outer cylindrical surfaces;

Photo D. Conformal spiral antenna.

The *Gazette* describes this antenna as a flexible substrate (the ribbon) with a conductive material attached to it in a predetermined pattern. The pattern isn't described in detail, but we can assume it is most likely used for matching, length adjustment, and Q adjustments. To make things more complex, this layer is covered with another layer of flexible insulating material which has a conductive material attached to it. To top off the sandwich, another layer of flexible, insulating material is then attached, to make three layers of insulation separated by two layers of conductive material.

The patent has been assigned to the Westinghouse Electric Company.

4,204,212
Conformal Spiral Antenna

There is no mention in the *Gazette* description of this antenna of what type of equipment it is intended to be used with. So, at this point, we can assume it is as useful as some designer wishes to make it. The US Army, in its wisdom, must think this is a useful invention, for they have been assigned the patent rights by the three inventors.

The unique design is made of a cylindrical dielectric tube. (See Photo D.) On the inner surface of the tube there is a conducting material which is described by the inventors as "a conductive ground plane." A spiral strip of conductive material is placed on the outside of the cylinder. All you need to do is connect the two conductive surfaces to your feedline, and you have a "conformal spiral antenna."

4,204,129
Capacitance-Compensated Cable

Perhaps the best explanation of this design for cable is that it turns the cable into a series-capacitor between the frequency generator and the load. The generator is connected to the center conductor of the cable and the load circuit is connected to the shielding of the cable. The two circuits are completed through ground. (See Fig. 6.)

In order to compensate for and control the capacitance, the surface area of the center conductor is designed to become smaller as it approaches the load, while conversely the surface area of the shield is designed to become smaller as it approaches the generator (or vice versa). ■

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Let's Go Shopping

—bagging the used gear bonanza

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The most agonizing ordeal you as a Novice must go through is not the code test, the written exam, or the waiting to hear whether you've passed the test or not. The worst thing you have to go through, by far, is choosing your first rig.

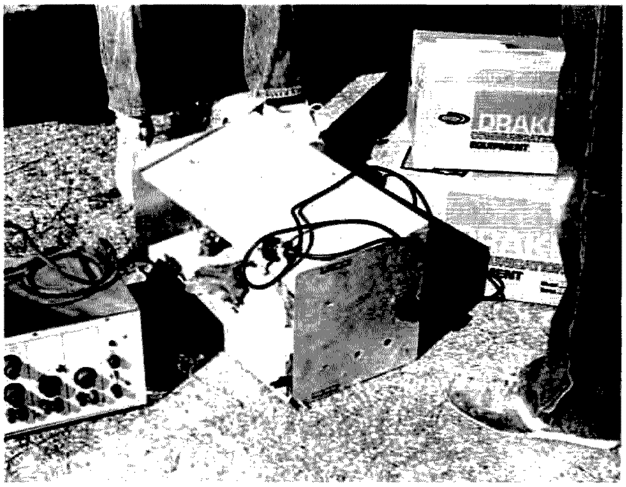
How do I know how much money I'll need? (You ask yourself.) Where is the money going to come from? How do I know what is a good price? What kind of rig do I need? What features do I need? I can't afford a new $1200 Superbolt III. But how do I tell if a used rig is any good? I don't even know one kind of rig from another. Where am I going to find one? *Where do I start?*

All these questions and more go through your mind when it's time to get a rig. If you're lucky enough to have a ham friend who has the time to help you choose and to go to hamfests to help you look over the rigs, you'll not be totally lost. But your friend can only advise you, not choose for you. You can't hold your friend responsible when it turns out your purchase doesn't do what you wanted it to do. He didn't know what you wanted any more than you did! You must face the ultimate responsibility of making *your* choice and spending *your* money.

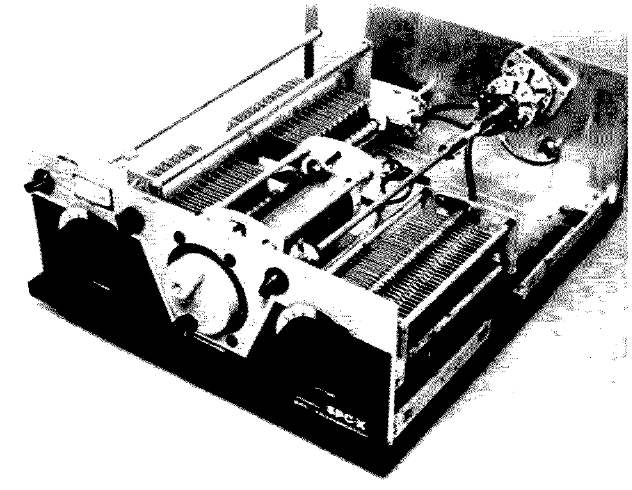
Whether or not you have a friend to help you, I think you will find this article helpful in deciding what you need, what you can afford, and how to go about getting it. It will guide you in organizing your thoughts and doing some conscientious planning *before* you take that important first step!

Where Will I Get the Money?

Empty your pockets and your piggy bank and count it. Uh huh, just as you thought, only $15.42 there. Well, where can you get more? How about selling something? Maybe you've outgrown your high school fixation about being in a



Would you give $3 for this junked home-brewed amplifier? I did. Along with plug-in coils, switches, insulated standoffs, and other goodies was the 12-inch long dual-section air-variable capacitor used in my home-built SPC transmatch. A real parts bonanza for just $3.



My home-built SPC transmatch uses the dual-section air-variable capacitor mentioned under the photo of the "junk." The single-section air-variable, the roller inductor with turns counter, and both vernier drives were salvaged from a junked military surplus transmitter purchased for $12 at a hamfest. The transmatch cabinet was designed to blend with my Drake equipment.

rock 'n' roll band. You never could play the electric guitar anyway, and it's collecting dust under the bed. Well, take it to the next hamfest and sell it for $50, or $100, or whatever you can get for it. How about that old dilapidated shortwave set your next-door neighbor gave you when you first got interested in radio? Maybe you can get $10 for it. If you have any hobbies like painting, woodworking, or arts and crafts stuff, you could try selling some of it. If you've ever been to a hamfest, you'll know that a ham is liable to buy anything. Hams have other hobbies and interests, too. Old model trains, guns, cameras, and many other items can get you a dollar or two if you're willing to part with them. So think hard! You can think of something to sell.

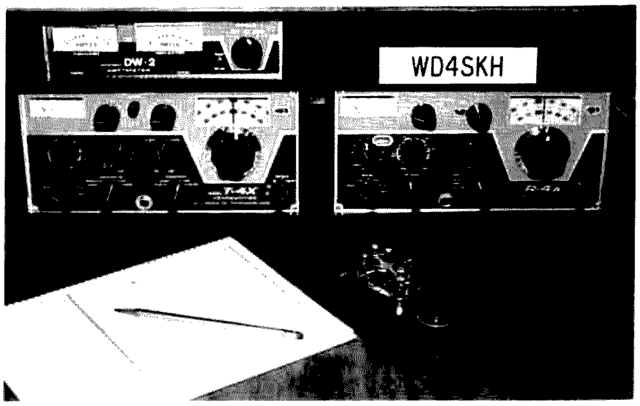
Am I Safe Buying Used Equipment?

Now that you've figured out where the money is coming from and how much you have to spend, you can begin deciding what you want to spend it for. You can purchase a used rig for around half its original price and get years of good service from it. If you buy good, clean used gear at a good or "steal" price, you can always sell it in a year or two for as much as you paid for it. In other words, as long as you take good care of it, your investment will not depreciate and you can get your money back to spend on a nicer rig when your finances allow such a move. That is the reason why good used equipment can be your best bargain.

El primo rule when buying used equipment is *buyer beware!* You can get taken by a shrewd seller more often than you can find a steal unless you exercise reasonable caution when buying. This is especially true when buying used transmitters, receivers, and transceivers. There can be aggravating minor problems that don't show up until you've had the rig on the air for a while. Usually the seller will admit to any obvious major problem with the rig being sold. Some will tell you every little detail, and some will swear it's in perfect shape when it's really a piece of junk. You and only you can be the final judge. If you can't tell by the look of the rig, then try to judge the look on his face.

Of course, no one selling used equipment can give you an ironclad one-year warranty on what he is selling. But if it hasn't given any major problems or had a recurring problem while he used it, you can assume you should have no major problems. If you can buy a rig from another ham you know and trust, you can probably get a better rig at a better price. In any event, when seriously considering buying *any* rig, ask to operate it, or test it out in some fashion before buying. This is an excellent way to see if you like the controls and features on the rig, as well as checking it for any defects.

In spite of a real need for such testing, it isn't always possible at a hamfest. In fact, it has been my experience that this is almost never possible at a hamfest. Hamfest organizers often claim they will have a testing area set up, but usually there is not even an electrical outlet set aside for such purposes. The minimum requirements would include a table, a dummy load for keying up, and some sort of wire hanging up for minimum reception. So if you want to buy at a hamfest and check out the rig first, at least ask, but don't be surprised if all you get is a run-around from the organizing club.



A matching transmitter-receiver combination is known as "twins." Shown here are my Drake twins, vintage 1967. In 1967, this set, with matching speaker and ac power supply, had a combined suggested retail price of over $950, including tax. They were purchased at a hamfest in 1978, complete and in excellent condition, for slightly over half the original price. The wattmeter atop the transmitter was home-built. Its cabinet was designed to blend with the Drake equipment.

What Is Better for Me, A Transceiver or Separates?

Now comes the question of whether to buy a transceiver or a separate transmitter and receiver combination. (By the way, a matching transmitter/receiver combination is known as twins. They usually look very much alike and are made so that they operate together without complicated external switching hookups.) Here are some points to consider when deciding on a transceiver or separates:

1) Transceivers are generally less expensive than a comparable set of matched twins.

2) Transceivers are generally easier to operate, due to the absence of controls duplicated in a set of twins (2 vfos, 2 band-selector switches, 2 tuning or peaking controls, etc.).

3) Transceivers can be more costly to have repaired due to the complexity of the combined transmit/receive functions crammed into one case.

4) Transceivers usually take up less space than comparable twins.

5) Twins are more versatile. Having a vfo on each unit gives you split-frequency operation without the purchase of an outboard vfo necessary for split-frequency operation with a transceiver. If one unit breaks down (the transmitter, for example), you still have the other unit to use (you can still receive and keep up your code practice) until repairs can be made.

6) Twins often have more good features as standard equipment than do transceivers.

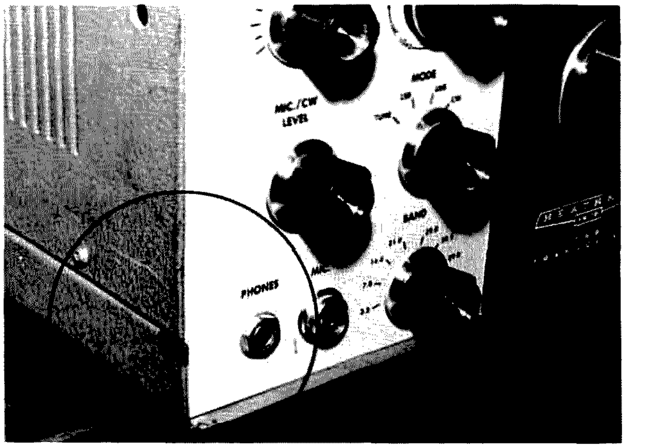
7) Separate transmitter and receiver units that are *not* matched (odd couples) can be hooked up, and in many cases may be less expensive than either twins or a transceiver.

Most Novices have no need for split-frequency operation available with twins or transceivers with an outboard vfo. Let your pocketbook be your guide on that point. Split frequency has its applications when working some DX, can be a help in contests and service nets, or it can be *confusing* if you don't pay attention to what you're doing.

How Much Is a Rig Going to Cost?

Now you should have

This is a popular model of transceiver, the Heathkit HW-101, purchased by one of my Novice students at a recent hamfest. A little bargaining got this gem, including ac power supply and CW filter, for only $175.



Don't let minor damage like chipped paint and superficial scratches (circled area) deter you from a good buy on an otherwise clean, operable rig.

three things taken care of: (1) where the money is going to come from; (2) how much money you have to spend, and (3) whether you are looking for a transceiver or separates. Now you have to decide which brands or models are within your financial means. This can be a specific unit to decide on, or it can be a list of several good possibilities in the range of your budget.

I strongly suggest checking the ham magazines for advertisements by dealers who list their used equipment and prices. These listings will give you a good idea of the market value of used units with the dealer's markup tacked on. Most dealers charge more than you'd have to pay for the same unit at a hamfest, but usually they have gone over the rig and checked it out before putting it on sale.

Many dealers will give some sort of warranty on used gear, too. If you like the idea of having the extra peace of mind that this might offer and you can afford the extra bucks, you might consider calling them. In any case, the information on current prices of used gear is an excellent help in judging the real value of a rig.

Compare the dealer's used prices with the prices in the classified ads of ham magazines. That also will help you develop some idea of fair prices for the rigs you are considering. (A word of caution is appropriate here if you are considering buying a rig from the classified ads. You're not only buying a rig from someone halfway across the country, but you're buying it sight unseen. At least at a hamfest you have the chance to look over the rig before you buy it. Prices in these classified ads can be a bit inflated, too. The seller must recoup his cost of advertising, and those ham ads do cost money.)

Another big help for me was a set of manuals called *Ham Equipment Buyer's Guide*, published by A.L. Brand WA9MBJ. They may be ordered from Barbara Brand Wixon, 189 Kenilworth, Glen Ellyn IL 60137. These manuals show pictures of commercial ham gear and military and government-surplus gear of interest to the amateur market. With each picture there is a description of the unit. Most have the date of manufacture or the date the unit came on the market, and its original retail price. These manuals cover gear from about 1945 to the present.

This was especially helpful to me in keeping all the Heathkit® rigs organized in my mind. There seemed to be so many that looked alike, I could never keep straight whether I was looking at a 6-meter rig or an HF rig. It was equally difficult for me to separate the transmitters from the receivers from the transceivers! It is a small investment when you consider that you may be preparing to spend $200 to $500 or even more on some equipment. Armed with this information, you now have something to choose from, and some idea of the cost.

Which Rig to Buy—When I Don't Know What to Look For?

Now comes the hard part. Different rigs have different features. What is standard on one rig may be an add-on option for another rig. The more goodies, such as RIT, audio filters, LED readouts, and speech processors, that the rig comes with, the more it is going to cost. If you've not operated any ham gear before, you may well have *no idea* what features you want in a rig or which features are worth the extra cost. So how do you know where to start choosing?

The following is a list of features you should consider and some explanations of what the feature is or does. Following each item are one or more letters. The T means that the feature is usually found on a transmitter, the R that it is found on a receiver, and the X stands for transceivers. Read over the list and ask each question appropriate to each rig you consider buying.

1) How many bands or portions of bands does the rig cover? Does it include a WWV receive function? If not, see item 5. (T,R,X)

2) Is it vfo controlled or single fixed-frequency crystal controlled? (T,R,X)

3) What is its rated input or output wattage? (T,X)

4) What modes does it have (AM, SSB, CW, RTTY, FM, etc.)? (T,R,X)

5) Is its band coverage easily expandable? Some rigs have accessory crystal sockets which give you extra band coverage in 400- to 600-kHz sections with the simple addition of one plug-in crystal. This is an important feature if you want to be ready for the new amateur bands recently allocated for our future use. (T,R,X)

6) For CW operation, does the rig have full break-in or semi-break-in? This

means you can hear your receiver audio between every dit and dah with full break-in, or only during longer pauses between words or sentences with semi-break-in. (T,R,X)

7) For phone operation, does the rig have PTT (Push To Talk), or VOX (Voice Operated Xmit—short for transmit), or both? (T,X)

8) Does the unit come with an outboard vfo, or at least have an accessory jack for an outboard vfo? (X)

9) Is the frequency readout digital (LEDs) or analog (dial markings)? (T,R,X)

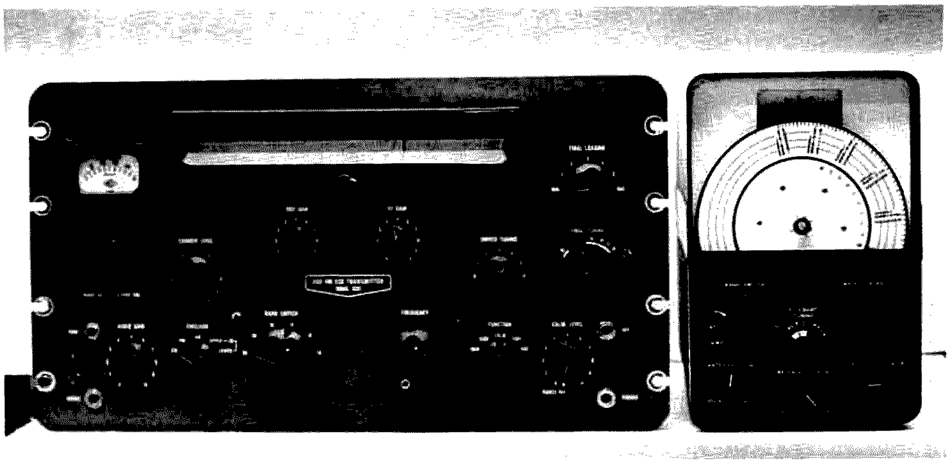
10) What is the bandwidth of the audio filters it comes with? For AM phone you need about 4.5-kHz to 5-kHz bandwidth, SSB phone requires about 1.5 kHz to 2.5 kHz, and CW, anywhere from 50 Hz to 500 Hz. There are two types of audio filters: active and passive. The active type amplifies the chosen audio-frequency band louder than the background, making it easier to hear over other audio. The passive type cuts down the background sounds and passes the chosen audio band. Active filters are less expensive but tend to sound harsher than passive filters. (R,X)

11) If it doesn't have the filter bandwidth you want as standard equipment, can it be purchased and plugged in inside the rig or must it be added externally? What would be the cost of the manufacturer's recommended plug-in type? (For example, new plug-in crystal filters can cost $40 and more!) (R,X)

12) Does it have a notch filter? This is sort of the opposite of an audio filter. A notch filter cuts out a particular thin band of audio. It is particularly helpful for filtering out a carrier signal in your audio. (R,X)

13) Does it have a noise blanker? (R,X)

14) Does it have RIT (Receiver Incremental Tuning—sometimes called a clarifier)? This feature allows you to shift your receive frequency 1 or 2 kHz without moving your transmitting frequency. This is a real help on a transceiver without an outboard vfo. (X)



At the left is a Gonset GSB-100 transmitter, vintage 1958, which sold for over $450 new. At the right is a Drake 1-A receiver, vintage 1959, which went for $300 new. These could be used as an "odd couple" to set up a Novice station. The Gonset is a rack-mount unit and should have some kind of cabinet on it for rf shielding and shock protection. It measures 10" × 18" × 20" and weighs 120 pounds! Be sure your operating table can handle it! (The decorative face plate is missing from the 1-A dial in this photo.)

15) Does it have a crystal calibrator (usually 25-kHz or 100-kHz increments)? A crystal calibrator is a built-in crystal oscillator which allows you to calibrate your vfo dial without having to use external test equipment. (T,R,X)

16) Does the rig come with its power supply built in, included as an accessory, or not included at all? (T,X)

17) Is the speaker built in, in a matching cabinet, or not included at all? (R,X)

18) Have there been any user-installed modifications? If so, what are they, and are they indicated on your schematic? (T,R,X)

19) Are the original operator manuals and schematics included? (T,R,X)

20) What is the appearance of the rig? Is it scratched, dented, rusty, cracked, knobs missing or mismatched, poorly repainted, etc.? (T,R,X)

21) Is the physical size and weight of the rig suitable for your available operating space and situation? (T,R,X)

22) What is the reputation within the ham community for the particular rig or rigs you are considering? (Examples: a reputation for frequency drift, poor audio quality, hard-to-find tubes, poor selectivity, hard-to-reach controls and adjustments, etc.) (T,R,X)

Boy, that sure sounds like a lot to think about, doesn't it? Well, it *is* a lot to think about. That's exactly the reason you should think about all these things *ahead of time*. You will find that before long you will automatically check for many of these items from memory, without having to refer to this list for them. Don't be afraid to take this article along as reference, though; you can't commit every one of these questions to memory. Mark those options you are considering. Star the ones you *must* have and mark the ones you would like but would pass over unless the price was right.

What Features Do I Really Need?

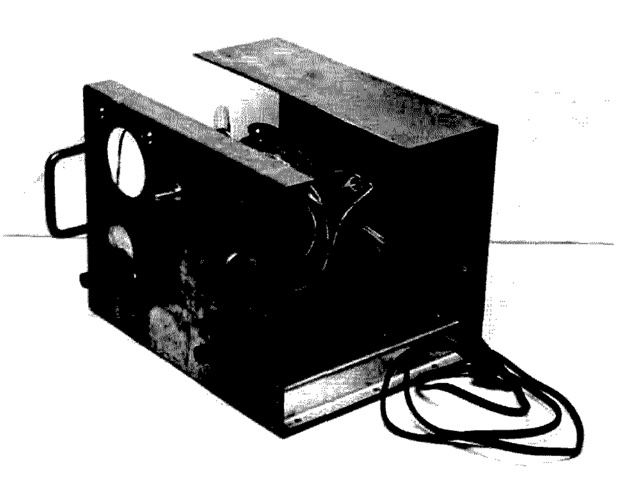
If you are still undecided about some of the features and options, the following list of comments and my own recommendations for Novices might help you decide. The numbering on this list corresponds to that of the previous list.

1) If you can afford an all-band rig, good! You will be happier with it in the long run. I recommend some type of WWV coverage. (Refer to item 5.)

2) Crystal control is pretty much a thing of the past. By the time you collect enough crystals to make a crystal rig of any value, you could have purchased a good vfo for the same money. If you can at all afford it, go for vfo control.

3) Wattage choice is a matter of preference (though the cost can be a minor factor). Many all-transistor rigs are 20-Watt input or less. Tube-type rigs generally run from 40- to 300-Watt input. The 50-to-100-Watt range is a good starting point for Novices.

4) As a Novice, you certainly need CW. SSB is a good option so that you won't *have* to buy again when you upgrade your license. AM, FM, and RTTY are of no particular value to



A home-brewed power supply like this one often can be purchased at a hamfest for less than the individual parts could cost used! Even if it doesn't work, you could use the good parts and cabinet and build your own. Refer to amateur publications like this magazine for construction projects on power supplies and many other useful items that are relatively easy to build.

you as a Novice.

5) If you can afford a rig with easily-expandable band coverage, get it. It will pay for itself in a couple of years when you upgrade, or when the new bands become available to amateurs. It is also an easy way to add WWV reception if the rig doesn't already have it. However, expandable band coverage is not a must for the Novice.

6) Full break-in or semi-break-in: The choice is a matter of personal preference. Full break-in normally is available only on the newer transistorized, digitalized rigs. Personally, I find full break-in annoying, but you should listen to a sample of it to decide for yourself. Semi-break-in is quite sufficient for the Novice.

7) VOX is nice when you upgrade, but is not a necessity for the Novice.

8) An outboard vfo on a transceiver is nice, but not a necessity for Novice use. RIT will serve you as well. However, if RIT isn't available on your rig you might consider an outboard vfo as a second choice if the price is right.

9) Digital readouts are pretty but definitely not a necessity for Novice use. Digital readouts cost more and give more trouble than an analog display. If you want pretty lights, get a good frequency counter. It will be of much more use to you now and later on.

10,11) The QRM on 40 and 80 meters can get awfully hairy in the Novice bands. A good audio filter can be a QSO saver and a nerve saver, too. The tighter the filter, the better. 500 Hz or tighter is good (almost a necessity) since you probably need all the help you can get copying CW on the air. Don't worry if the rig you pick out doesn't have a tight CW filter, though. You can build a good add-on active or passive filter from any of several projects covered in the ham magazines and other publications.

12) A notch filter is not a necessity, though it can be especially helpful on 40 meters where there are a lot of shortwave carriers.

13) If your choice of rig has a noise blanker, fine. But the cost of an add-on noise blanker could prove prohibitive to your budget. You don't really have to have one.

14) I recommend RIT if you get a transceiver. There are articles showing how to add RIT to many rigs. If the one you want doesn't happen to have RIT, check the annual indexes of the ham magazines (December issues) and other publications to see if there is an RIT modification for the rig you're considering.

15) If your choice of rig has a crystal calibrator, so much the better. You should have one. But if it doesn't, you can probably add one. Refer to the many amateur publications for details.

16) You *must* have the proper power supply for your rig. When buying a used rig, deduct from the going price if the power supply isn't included. You have to get one from somewhere, and they tend to cost more and are harder to come by when purchased individually. This is especially true of supplies for tube-type rigs. A 12-to-13-volt dc supply isn't as critical or as hard to find, though must still meet manufacturer's specifications for the supply for your rig.

17) You can buy a good speaker for a dollar and put it in some kind of enclosure if you have to. But deduct from the asking price if the receiver you want doesn't have a built-in speaker or a matching speaker cabinet.

18) User-installed modifications can be nice, but if they are poorly or improperly installed they may do more harm than good. Check workmanship carefully and see that it is marked in the schematic or manual with the unit.

19) You need the manuals and schematics. If they don't come with the rig, knock $3 to $5 off the price. You're going to have to order them and pay for them elsewhere.

20) If the rig looks bad, it's probably been taken poor care of. Beware. Also, you should learn to recognize the difference between fair wear on older equipment and downright mistreatment and abuse. Don't knock too much off the price for fair wear, but watch out for excessive wear or abuse.

21) Certainly don't get a rig that's too big and heavy for your flimsy operating table! However, if you have the room, some of those old, large rigs have a lot of good spark left in them, and they're cheaper, too!

22) Put your ear to the ground and listen. Reputations may or may not be fair. Often there is a simple modification that can cure the reputed problem with a certain rig. Ask around and see what you can find out. Write the manufacturer. He may be able to tell you what needs to be done to correct the problem.

What About Home-Brewed Equipment?

By now you should be well along in deciding what you want in a rig. However, there are still more things to consider before buying. Besides commercially-manufactured gear, you may come across home-brewed equipment for sale at hamfests. You should be especially cautious of home-brewed transmitters and receivers. You have no way of knowing the spectral purity of the transmitters or the sensitivity of the receivers. Often they don't even have a schematic so that you could troubleshoot any problems. Workmanship may be shoddy, though you can find beautifully-built home-brews on occasion.

It's a different story with home-brewed equipment such as antenna tuners, power supplies, and other simple-to-build items. Many times you can find a home-brewed antenna tuner for

sale for less than the individual parts and cabinet are worth. You may find a home-brewed power supply for less than the transformer and capacitors in it are worth! These can be excellent buys, even if only for parts. But other items such as frequency counters, electronic keyers, and other complicated equipment can be a real headache if home-brewed.

(While on the topic of electronic keyers, I wholeheartedly discourage Novices from using electronic keyers. A good military surplus straight key can be purchased for as little as $3. That's hard to beat on a tight budget. Electronic keyers are difficult to operate properly and sound absolutely horrid when poorly operated. The money spent on one can be much better spent on a dummy load, coaxial switches, antenna and tuner parts, etc.)

Another item found at hamfests is ye olde 23-channel (or 40-channel) CB mobile rig. For $10 to $60 you can get an AM or SSB CB for conversion to 10 meters. That's a cheap way to get on the air if you don't mind being limited to a single band. If you're not afraid to try a CB-to-10-meter conversion, then you might even consider trying to home-brew your own CW transmitter. Especially if you are willing to try QRP work, your chances of home-brewing a good CW transmitter are good. If you can get help from another ham who is an experienced builder, you will find that help very valuable with such a project. And a home-brewed direct-conversion receiver isn't so bad either. So keep these options in mind if your budget is limited.

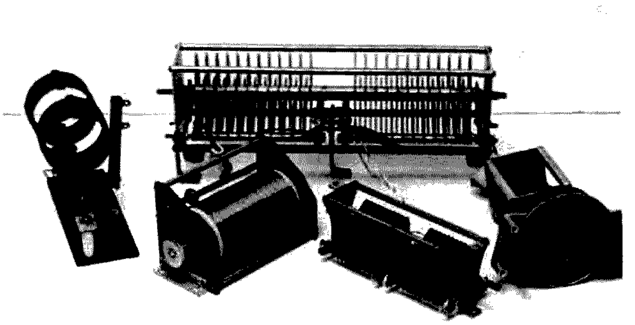
Anything you can home-brew for your station helps take the strain off your finances, and it gets you off on the right foot. Part of what being a ham is all about is being as self-sufficient as possible and not being afraid to try things yourself. Most everyone can build an antenna tuner, an swr meter or wattmeter, and other small items which can run into a lot of money if purchased commercially. I encourage Novices to home-brew as much of their station as their time, tools, workspace, courage, and talent will allow. If you've never tried it, you're missing part of the total experience.

I Think I'm Ready to Buy Now...

Don't forget that you have an option not to buy but to *swap*. You may be able to work out a good deal by swapping your old guitar for something you want. Or you could swap it for something you don't especially want which is worth more than your guitar and probably easier to sell. Then you could either swap that for something you *do* want, or you could sell it and use the money to get what you want.

When swapping or buying, a good rule to follow is: *Don't pay the asking price.* Even if the asking price is a fair price (according to your careful research and pre-planning), offer less! If your offer is accepted, fine. If not, you can probably agree on a price that's acceptable to both of you. But if you don't offer less, you'll never know if you could have gotten it for less.

Two dollars saved here and three dollars saved there will buy that five dollar item later. If you can't agree on a price that's acceptable to you, walk away. You may get called back, on your terms, before you've taken two steps! In any event, decide what your top dollar will be and don't pay more than that for it, even if it hurts. There are other fish in the sea. If you look on the next row of tables, you may find just what you want for less than you expected to pay.



When searching for goodies such as coils, roller inductors, and capacitors for your antenna tuner and other projects, don't pass up goodies like these because they are hidden inside something else. You very often will find the best bargains by rummaging around in and under what looks like junk! Be curious when shopping at a hamfest! The large capacitor in this photo is over 14 inches long!

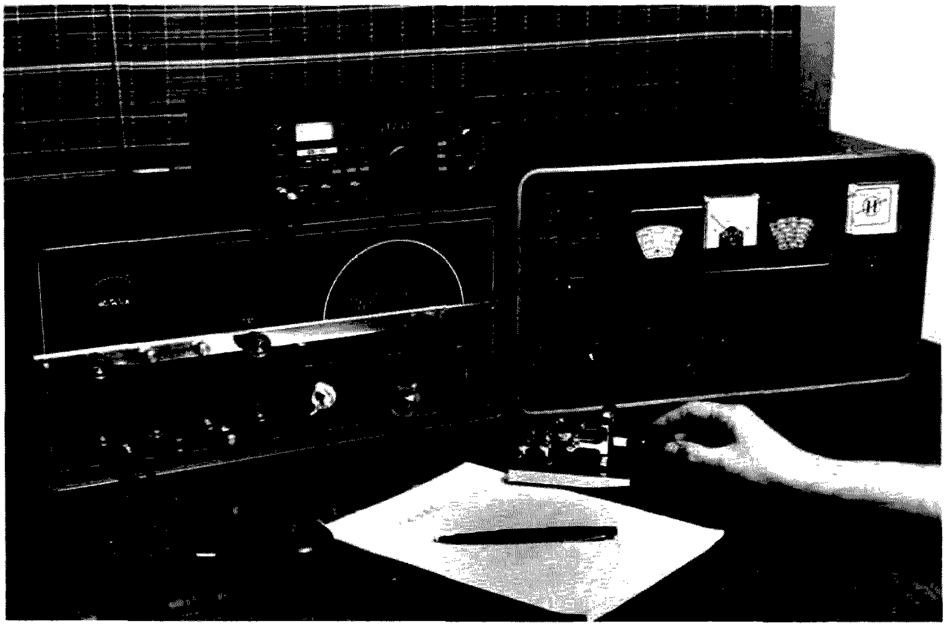
Of course, there are exceptions to this rule. Once you've gained some experience, you can spot a real steal when you see it. In such cases, it's often better to pay the price. If you wait until later, the guy behind you will have already paid the price and gotten the bargain. So if you're *sure* it's a steal, buy it whether you need it or not. You can put it on your table and sell it for nearer the usual asking price and make a little money on it, giving you just that much more cash on hand to get what you really need. With a little experience, you can become a real horse trader and still turn an honest dollar. A real steal at $3 can be bought and resold at an honest fair market price of $10, and you'll undersell the crook at the other table trying to get $20 for the same thing!

Ready to Go... Did I Forget Anything?

If you can remember the guidelines I've covered here, you will feel much more confident about your ability to judge used gear and its real worth. You'll not only be able to spot a good buy, like an old-timer, you'll be able to spot the rip-offs and junk, too. You'll know the right things to look for and to ask about before laying out your hard-earned money.

Plan ahead and know what you want and how much you'll pay for it. And when you find what you're looking for, stick to your top dollar and don't pay a penny more! Never go off half-cocked. If you have planned and prepared well, the time you've put in before the hamfest will save you money and anguish when trying to decide what to do. Don't buy the first thing you see unless you *know* it is a real bargain. Take your reference along for double-checking when your memory becomes foggy.

Check out the condition of transmitters and such carefully. Outward appearance is a hint, but testing is the *only* way to spot problems. If possible, have an experienced friend help you. Just having someone assisting in spotting what you're after can be more help than you realize. If your friend knows about used equipment, he can help advise you on its con-



The old and the new together: an Icom IC-730 transceiver sits atop an "odd couple." Left is a Hallicrafters HT-37 transmitter, vintage 1960, which listed for $450 new. At the right is a Hammarlund HQ-145-X receiver, vintage 1961, which listed for $285 new. Combined, they weigh 122 pounds! By comparison, the IC-730 will do everything the older pair will do, and comes in a package less than 4 × 10 × 11 inches! The 1981 vintage Icom lists for $829. The older pair can be purchased now for about half their original price.

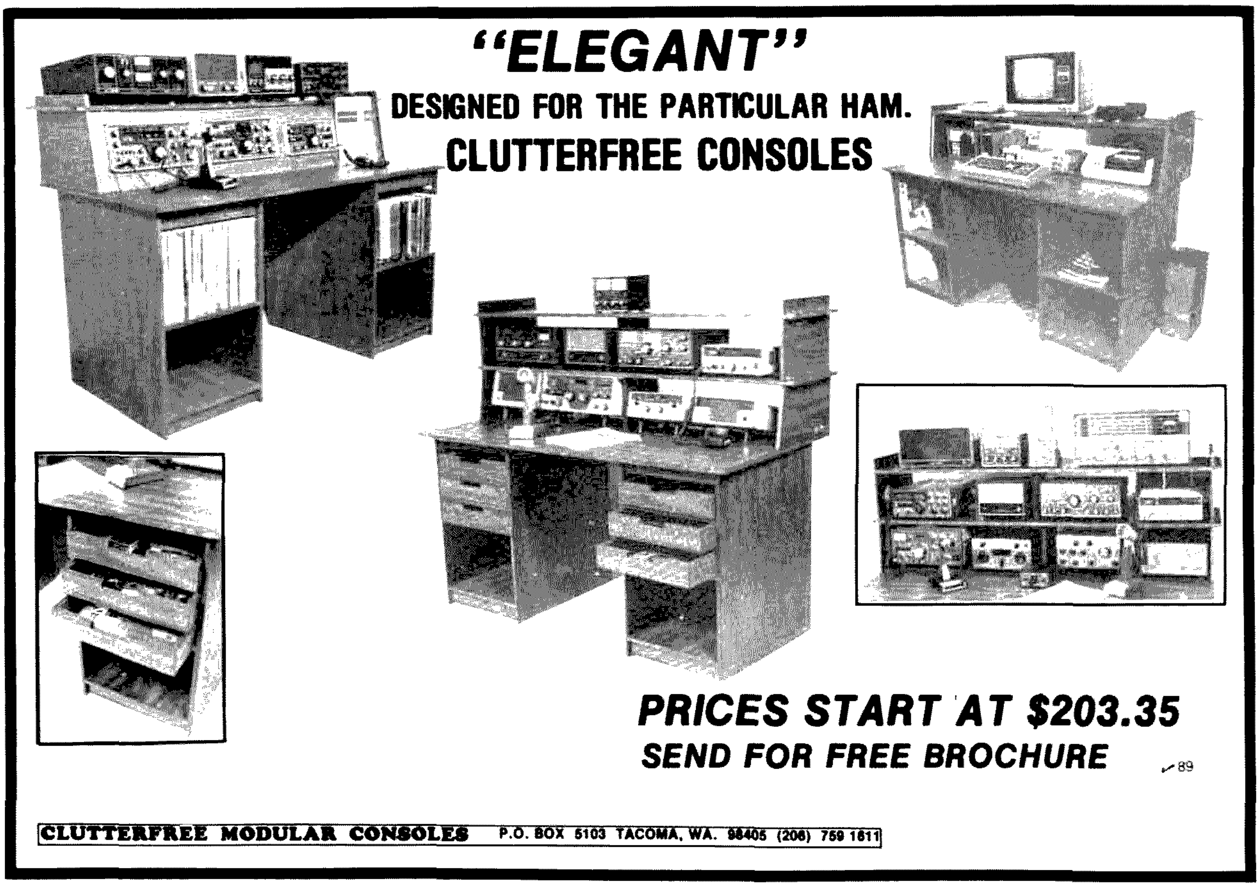
dition. He may be more experienced at spotting little things that you may overlook.

Even without the help of a friend, if you have prepared well you won't be totally at the mercy of the other guy's honesty or dishonesty. If you talk and look as if you know what you're doing, there's less chance the seller will try to take you for a ride at your expense. The only thing better than the *knowledge* you should now have is real *experience*. But that, too, will come in time.

I haven't forgotten my first attempt at purchasing a receiver and transmitter. If you follow these guidelines and suggestions, you can avoid the mistakes I made. I learned the hard way, but you don't have to. So go get 'em, tiger. And good luck! ■

Acknowledgement

My thanks to N4BGU and KA4YBJ for their assistance in assembling equipment for photos. Also a special thank you to KZ4J for his photo of "The old and the new together."



SOCIAL EVENTS

from page 61

22nd annual ARRL-approved Lafayette Amateur Radio Hamfest on Saturday and Sunday, March 13-14, 1982, at the Evangeline Downs Racetrack Club House facility, located directly off Highway 167, five miles north of Lafayette LA.

WINCHESTER IN
MAR 14

The Randolph Amateur Radio Association will hold its 3rd annual hamfest on Sunday, March 14, 1982, from 8:00 am to 5:00 pm at the National Guard Armory, Winchester IN. Tickets are $2.00 in advance and $3.00 at the door. Table space is $2.50 and table space with table is $5.00. Setup times are 6:00 pm to 8:00 pm on Saturday and 6:00 am to 8:00 am on Sunday. For reservations or additional information, contact RARA, PO Box 203, Winchester IN, or phone W9VJX at (317)-584-9361.

MARSHALL MI
MAR 20

The Southern Michigan ARS and the Calhoun County Repeater Association will hold the 21st annual Michigan Crossroads Hamfest on Saturday, March 20, 1982, at the Marshall High School, Marshall MI. Doors will open at 7:00 am for exhibitors and 8:00 am for buyers and lookers. Free parking, carry-in help, and full food service will be available at the school. Table space is $.50 per foot and will be reserved until 9:00 am. Talk-in on .07/.67 and .52. For more information, write SMARS, PO Box 934, Battle Creek MI 49016, or call Earl Goodrich at (616)-781-3554.

GRAYSLAKE IL
MAR 20

The Civil Air Patrol will hold its second annual spring hamfest on Saturday, March 20, 1982, at Lake County Fairgrounds, US 45 and 120, Grayslake IL. Donations are $2.00 and tables are $3.00. For more information and reservations, send an SASE to Captain Ed Rehm W9NXR, 637 Emerald Street, Mundelein IL 60060.

FORT WALTON BEACH FL
MAR 20-21

The Playground Amateur Radio Club will hold its 12th annual swapfest on Saturday, March 20, 1982, from 8:00 am to 4:00 pm and Sunday, March 21, 1982, from 8:00 am to 3:00 pm at the Okaloosa County Fairgrounds, Fort Walton Beach FL.

IRVINGTON NJ
MAR 21

The Irvington RAC Hamfest will be held on Sunday, March 21, 1982, from 9:00 am to 4:00 pm at the P.A.L. Building, 285 Union Avenue, Irvington NJ. Take the Garden State Parkway to exit 143 north 143B south. Admission is $1.00 and tables are $3.00. Refreshments will be available. Talk-in on .34/.94 and .52. For additional information, call Ed WA2MYZ at (201)-687-3240 or write IRAC, P.A.L. Building, 285 Union Avenue, Irvington NJ 07111.

JEFFERSON WI
MAR 21

The Tri-County Amateur Radio Club will hold its annual hamfest on March 21, 1982, from 8:00 am to 3:00 pm at the Jefferson County Fairgrounds, Jefferson WI. Tickets are $2.50 in advance and $3.00 at the door. Tables are $2.50 in advance and available at the door for $3.50. Parking is free and there will be plenty of food, beer, and prizes. The grand prize will be awarded at 2:30 pm. Talk-in on 146.52 and 146.22/.82. For more information, advance tickets, and tables, send an SASE to Horace Hilker K9LJM, PO Box 204, 261 E. High Street, Milton WI 53563.

COLUMBUS GA
MAR 27-28

The Columbus Amateur Radio Club will hold its annual hamfest on March 27-28, 1982, at the Columbus Municipal Auditorium, Victory Drive (US 280) at the south end of 4th Avenue (Highway 27), Columbus GA, from 9:00 am to 5:00 pm on Saturday and from 9:00 am to 3:30 pm on Sunday. Features will include a flea market, free overnight parking at hamfest site for self-contained campers, free coffee and hot chocolate, inside exhibits, and many prizes (including a main prize of a Radio Shack TRS-80 Mod III). Ticket donations are 6 for $5.00 or 13 for $10.00. To reserve inside table space at $3.00 per table per day, contact Jeannie Hunting K4RHU, 2701 Peabody Avenue, Columbus GA 31904, or call (404)-322-7001. Talk-in on .01/.61 N4BJZ/R. For additional information, write CARC, PO Box 6336, Columbus GA 31905.

ST. LOUIS MO
MAR 27-28

The Gateway Amateur Radio Assn. will hold ARCH '82, an official ARRL convention, March 27-28, 1982, at the Chase Park-Plaza Hotel, St. Louis MO. Advance tickets are $3.00. Features for the amateur radio operators and computer hobbyists will include a flea market, workshops, forums, major national exhibitors and dealers, prizes, ladies' activities, and a Saturday evening banquet. Special hotel accommodations will be available. For additional information, contact Gateway Amateur Radio Assn., PO Box 8432, St. Louis MO 63132, or phone (314)-361-4965.

MADISON OH
MAR 28

The Lake County Amateur Radio Association will hold its fourth annual Lake County Hamfest on Sunday, March 28, 1982, at Madison High School, Madison OH. Admission is $2.50 in advance (send an SASE before March 14, 1982) and $3.50 at the door. A table and display space is $5.00 for a 6-foot table and $6.50 for an 8-foot table. A table donation with a reservation will hold a space until 10:00 am. There will be plenty of free parking, commercial exhibits for ham and computerist, an inside flea market, door prize drawings hourly, and a main prize drawing at 3:05 pm. Hours will be from 8:00 am to 4:00 pm and vendors may set up at 6:00 am. Overnight accommodations are available within a 15-minute drive. Talk-in on 147.81/.21. Check-in on 146.52/.52. For further information or reservations, send an SASE to Lake County Hamfest Committee, 1326 East 349th Street, Eastlake OH 44094, or call (216)-953-9784.

GRAYSLAKE IL
MAR 28

The Libertyville and Mundelein Amateur Radio Society (LAMARS) will hold its annual hamfest on March 28, 1982, at the Lake County Fairgrounds, located at the intersection of Rtes. 120 and 45, Grayslake IL. Tickets are $2.00 in advance or $2.50 at the gate. Doors open at 8:00 am. Hot food and drink will be available, as well as 9-foot tables at $5.00 per table. Prizes,

CORRECTIONS

Readers who build the VE3CYC ATV project beginning on page 20 of this issue should include the following changes to make the converter more stable and less sensitive to antenna and feedline changes:

1) Install the MRF901 transistors from the foil side of the board.

2) Referring to Fig. 8 in the article, add a 68-Ohm resistor directly across the 440-MHz input cable on the circuit board. Solder one end of the resistor to the stripline near the center conductor of the coax. The other end of the resistor should be soldered directly to the circuit board ground foil.

Jeff DeTray WB8BTH
***73 Magazine* Staff**

The schematics in "TVRO Signal Source" (page 46, January, 1982), are missing a resistor between the +12-V terminal and the collector of the oscillator transistor. This part should be added to Figs. 1 and 2.

Tim Daniel N8RK
***73 Magazine* Staff**

Paul Grupp KA1LR's review of the AEA MBA Code Reader in the January, 1982, issue of *73* mentioned that a cure is available to reduce noise emitted by the unit's microprocessor. AEA informs us that this cure is very simple: Just put a bypass capacitor at the power-line input.

Tim Daniel N8RK
***73 Magazine* Staff**

including a synthesized HT, will be awarded to licensed amateurs. Talk-in on 146.94 and 147.63/.03 (Waukegan repeater). For reservations or tickets, write WA9HRN, Chairman, LAMARS, PO Box 751, Libertyville IL 60048 and include an SASE.

SEWARD PA
MAR 28

The Conemaugh Valley Amateur Radio Club will hold its fifth annual hamfest on March 28, 1982, from 8:00 am until 4:00 pm at the Sandy Bottom Sportsman's Club, Seward PA, approximately ten miles northwest of Johnstown on Rte. 56. There will be plenty of food and refreshments available, as well as many good prizes. Talk-in on 146.34/.94.

BALTIMORE MD
MAR 28

The Baltimore Amateur Radio Club, Inc., will hold the 1982 Greater Baltimore Hamboree and Computerfest on Sunday, March 28, 1982, beginning at 8:00 am at the Maryland State Fairgrounds Exhibition Complex located at exit 17 of I-83, three miles north of I-695 (near Baltimore) in Timonium MD. Admission is $3.00. Amateur radio, personal computer, and small business computer dealers will be featured at the dealers' display area. There also will be an indoor flea market, an outdoor hard-surface tailgate area, food service, free parking, hourly door prizes, and cash grand prizes. Talk-in on .34/.94 and .07/.67. For more information and table reservations, contact GBH&C, PO Box 95, Timonium MD 21093, or call (301)-561-1282. For a recorded announcement, dial (301)-HAM-TALK.

TRENTON NJ
MAR 28

The Delaware Valley Radio Association will hold its annual flea market on Sunday, March 28, 1982, from 8:00 am to 4:00 pm at the New Jersey National Guard 112th Field Artillery Armory, Eggerts Crossing Road, Lawrence Township NJ. Advance registration is $2.50; $3.00 at the door. There will be indoor and outdoor flea market areas, door prizes, raffles, refreshments, and FCC examinations. Sellers are asked to bring their own tables. Talk-in on 146.07/.67 and 146.52. For further information, write DVRA, PO Box 7024, West Trenton NJ 08628.

FRAMINGHAM MA
APR 4

The Framingham Amateur Radio Association will hold its 6th annual spring flea market on Sunday, April 4, 1982, at the Framingham Police Station drill shed, Framingham MA. Admission is $2.00. Sellers' tables are $8.00 before March 27, and $10.00 after that date. Doors will open at 10:00 am but sellers may begin setting up at 8:30 am. Radio equipment, computer gear, food, and bargains will be available. Talk-in on .75/.15 and .52. For more information, contact Ron Egalka K1YHM, 3 Driscoll Drive, Framingham MA 01701, or phone (617)-877-4520.

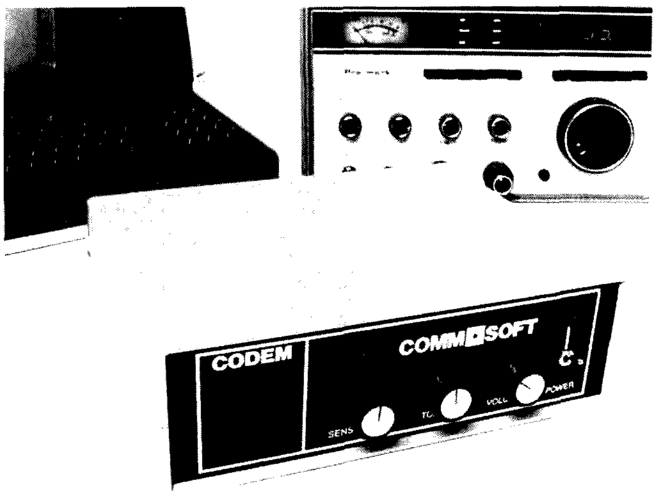
GRAND JUNCTION CO
APR 17

The Grand Mesa Repeater Society will hold the third annual Western Slope Swapfest on Saturday, April 17, 1982, from 10:00 am to 4:00 pm at the Plumbers and Steamfitters Union Hall, 2384 Highways 6 and 50, Grand Junction CO. Admission is free and swap tables are $5.00. Features will include an auction, door prizes, and refreshments. Talk-in on .22/.82. For further information, send an SASE to Dale Ellis KDØM, 588 Starlight Street, Grand Junction CO 81501, or call (303)-434-5981.

RALEIGH NC
APR 18

The Raleigh Amateur Radio Society will hold its 10th annual hamfest on Sunday, April 18, 1982, from 8:00 am to 4:00 pm at the Crabtree Valley Shopping Center parking area, Raleigh NC. Admission is $4.00; there will be a table charge for exhibitors and flea market displays. First prize is a choice of a Kenwood TS-830S transceiver or an Icom IC-251A multi-mode 2m transceiver with a Mirage B108 80-Watt amplifier. A hospitality room and party will be held the preceding evening from 7:00 pm to 10:00 pm. Talk-in on 146.04/146.64 and 146.28/146.88 both days. For more information, please contact Ken Boggs KB4RV, 8704 Cliff Top Ct., Raleigh NC 27612, or phone (919)-782-8646.

Two Keys To Perfect Code...



The CODEM: a universal CW interface for your personal computer.

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Here is an easy way to get your Morse code software on the air! The CODEM converts received CW audio to RS232 or TTL signal levels and RS232 or TTL signal levels to transmitter keying. The CODEM doubles as a code practice oscillator and CW regenerator. A sharp 800 Hz bandpass filter, AM detector and low pass filter are designed into the CODEM to provide outstanding noise and QRM rejection. Requires a 9 VDC power supply.

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NEW PRODUCTS

DX PREFIX LIST DX-1

The DX Prefix List is a custom-printed list of 367 separate places, including all of the current ARRL DX countries. Each location is calculated by pinpointing two locations. The DX Prefix List has 10 unique columns of information. First the list is arranged alphabetically and numerically by prefix. The next column contains the name of the country. The third column describes each CQ continent, while the fourth column lists the CQ zone. The ITU zone is listed in the fifth column. Columns six and seven give the short and long path distances in statute miles. The eighth and ninth columns provide bearings for short and long path. The rest of each line has a checklist to tally contacts, SSB or CW, and receipt of a QSL.

The DX Prefix List is priced at $6.95 (plus $1.50 shipping). Each listing is custom-printed for your station's location. For more information, contact *DX Prefix List, Jon Presley WDØEAO, Route 3, Box 117, Lebanon MO 65536.* Reader Service number 477.

QUAD BANDER ALL-MODE TRANSCEIVER

Trio-Kenwood Communications has announced a unique new radio, the TS-660 "Quad Bander," an all-mode transceiver designed for operation on 6, 10, 12, and 15 meters. The unit features built-in dual vfo's, a five-channel memory, and memory scan. Modes of operation are FM, SSB (USB), CW, and AM.

The TS-660's rf output power is 10 Watts on SSB, CW, and FM, and four Watts on AM. The radio operates from a 13.8 volts dc power supply. Kenwood's list price is $699.95. Additional information may be obtained by contacting *Trio-Kenwood Communications, PO Box 7065, Compton CA 90224.*

COAXIAL ANTENNA

Power Gain Systems has announced a coaxial antenna that offers a new approach to the construction of the well-known double-bazooka dipole design. The antenna has the broadband, low swr characteristics of the bazooka and features injection-molded plastic construction for weatherproofing, strength, and durability.

The antenna comes with an SO-239 fitting and is ready to accept any length of 50-Ohm feedline without the necessity of a balun or tuner. Available for 80 through 10 meters, the Power Gain Systems coaxial dipole costs between $34.95 and $39.95. For more information, contact *Power Gain Systems, 1007 Cypress St., West Monroe LA 71291; (315)-325-4754.* Reader Service number 476.

10-kHz-TO-30-MHz TUNER

The new Signa/Match from Grove Enterprises is a state-of-the-art frequency-selective tuner designed to optimize impedance matching between 10 kHz and 30 MHz. It will reduce, and in many cases remove, receiver intermodulation, images, and front-end overload. Background noise is reduced. VLF signals you never dreamed were there come roaring in loud and clear.

Kenwood's Quad Bander all-mode transceiver.

Front-panel switches allow instant selection between two antennas and between two receivers (or two antenna inputs to one receiver). Matched rotary switches permit the listener to peak signal strength of the frequency of interest, while a main tuning dial provides sharp resolution of the final signal. Priced at $99.95, Signa/Match comes complete with instruction manual and all interconnecting cables. For further information, contact *Grove Enterprises, Dept. C, Brasstown NC 28902; (704)-837-2216.* Reader Service number 478.

3.3-METER DISH

The Director III satellite receiving antenna from International Satellite Video Corporation utilizes space-age materials and technology for a unique lightweight design. The 3.3-meter dish has a high-efficiency Cassegrain (dual reflector) feed system which places receive electronics at the rear. The unusual perforated aluminum reflector surface with approximately 80% open area is almost impervious to wind.

The Director III is supplied with a correcting polar mount so that satellite selection requires only one adjustment. The complete system may be shipped by UPS. Installation time is approximately 2-3 hours. Options include programmable remote sat-

Grove Enterprises' Signa/Match.

The Director III 3.3-meter dish.

ellite aiming and electronic polarity selection. The Director III is available from *International Satellite Video Corp., Box 5685, Orange CA 92667; (714)-998-6080.* Reader Service number 481.

HF SWR/WATTMETER

MFJ Enterprises is introducing its new MFJ-816 low-cost HF swr/wattmeter for the 1.8- to 30-MHz range. Features include toroidal pickup for uniform sensitivity over the entire HF frequency range, dual ranges (30 and 300 Watts), and a two-color meter scale.

The MFJ-816 HF swr/wattmeter is priced at $29.95 (plus shipping and handling). For more information, contact *MFJ Enterprises, PO Box 494, Mississippi State MS 39762; (800)-647-1800.* Reader Service number 479.

SATELLITE TV RECEIVER

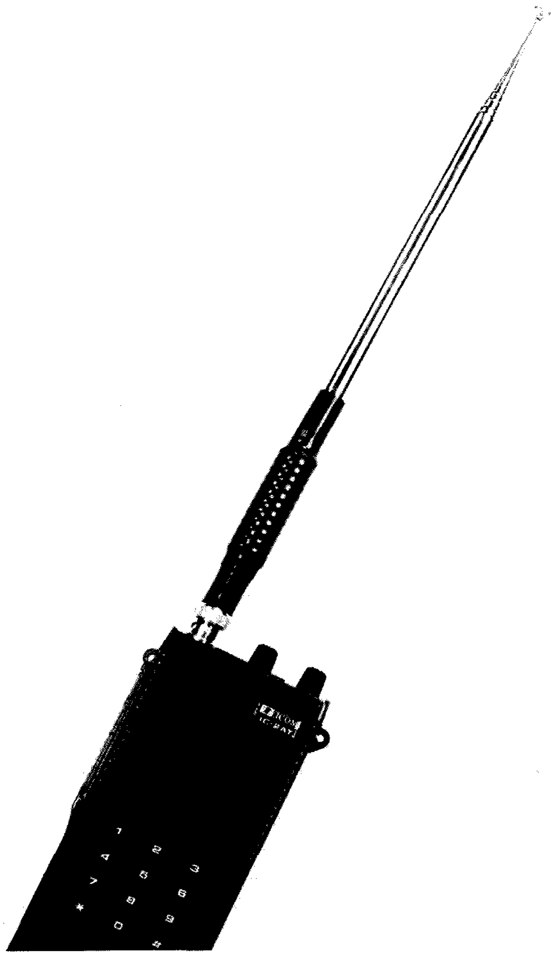
Telecom Industries' new TIC 1240 satellite television receiver now provides improved AFC and scan tune (for fast and easy satellite locating) as standard features. Improved threshold combined with better video resolution provides picture quality found in receivers twice the price.

The dual-conversion downconverter (204A) mounts directly at the LNA output while providing +15 volts through the N connector as well as externally. Improved environmental characteristics include hermetically-sealed connectors and temperature compensation for a virtually drift-free picture. The TIC 1240, with a retail price of $995, is available from *Telecom Industries Corp. 27 Bonaventura Drive, San Jose CA 95134; (408)-262-3100.* Reader Service number 482.

5/8-WAVE HT ANTENNA

The Tuned Antenna Company has announced a two-meter 5/8-wave antenna, the Super Stick II, for use on hand-held radios. The Super Stick II, when fully extended, offers 6 to 9 dB of signal output over traditional rubber duck antennas. All connections are soldered and copper-plated for years of troublefree service. The Super Stick II has been designed to operate when collapsed, giving performance equal to or better than a rubber duck antenna.

Super Stick II is available with BNC, 5/16-32, F, TNC, or PL-259 connectors, at a suggested retail price of $19.95. For more information, see your local ham dealer or contact the *Tuned Antenna Company, 9520 Chesapeake Dr. #606, San Diego CA 92123.* Reader Service number 480.



The Tuned Antenna Company's 5/8-wave HT antenna.

LETTERS

TO BE A DXER

I enjoyed very much the interview with the Colvins of Yasme fame in the October, 1981, issue of *73*. Many DXers I know would give their right 3-500Z to go on a DXpedition like those the Colvins are famous for. To be a DXer one must incorporate feelings about being on the other end of the microphone. Some day I'll be there, but for now, CQ DX.

Michael Weber WB8RDN
Cincinnati OH

EARTH PEOPLE

I was recently rummaging through *Sailing*, a new book of whimsical nautical definitions by Henry Beard and Roy McKie. Therein I encountered the following unlikely commentary: "Citizens Band Radio—Part of a government study of terrestrial radio emissions to determine if intelligent life exists on Earth. None has so far been detected." 10-4!

Robert Rice WB7VIP
Oak Harbor WA

SING ALONG

Kit K5KL and *73 Magazine* are to be congratulated for the fine story, "Update your CW Music Keyboard," In the December issue. It is hoped that this article will motivate others to write about their experiences and improvements.

CW music keyboards ("This Station Plays Beautiful CW," *73 Magazine*, February, 1979) are playing from Auckland (Fred ZL1ALP/MM) to Vienna (Hans OE1WH) with many in between. My mail indicates that others also could write interesting stories and additions and improvements for the CW music keyboards. Topics mentioned to me include: hard copy, expanded memory, speed indicator, replacing the 4078, use of the 3351 and a single-voltage power supply, solving propagation-delay problems, Crom was wrong to badmouth wirewrap, and many others.

If anyone still has a problem, be advised that I still answer all letters. Please include an SASE.

Russell C. W. Crom AG9N
Mt. Prospect IL

WATCH IT!

In the article, "Ham Shack Design for Beginners," a very dangerous situation could develop if a reader followed the author's advice. I am referring to questions two and three that deal with fusing both the hot and the neutral.

In the National Electrical Code, 1981 edition, Article 240, Section 20, it states: A fuse or an overcurrent trip unit of a circuit breaker shall be connected in series with each ungrounded conductor.

Section 22 of Article 240 goes on to say: No overcurrent device shall be connected in series with any conductor that is intentionally grounded.

Besides being against the Code, the article's suggestion could pose a serious hazard. If the neutral fuse should open, the equipment, though not operational, would still be

energized and a possible hazard.

Although I do not agree with the author's suggestion that the neutral be fused for lightning protection, it can be done according to the Code by using a special breaker that disconnects the neutral simultaneously. This is commonly used in service-station wiring.

Gary Strong KB0UI
Auburn KS

MAJORITY OF ONE

I am firmly opposed to any type of no-code license on any band. You have constantly criticized the League for forcing incentive licensing upon us despite the majority of active amateurs being firmly against the whole concept. Now you have somehow arrived at the idea that we need a no-code license and openly admit you will push for it despite the wishes of the majority of amateur radio operators. I find this contradictory, to say the least.

You also state that amateur radio needs leaders. Well, that is true, but we need leaders who are responsive to the wishes of the majority of all operators, not to the wishes of "thousands" of would-be amateurs who want to be licensed at their own terms. We also do not need any self-appointed leaders who decide single-handedly what is good or bad for amateur radio.

A true leader should always work with the majority to develop new ideas and accomplish needed improvements. This is a democracy, and that's the way it works.

Charles E. Daum WA4YZF
Lutz FL

Charles, aren't you a little confused between what is a leader and what is a follower? You seem to be looking for a leader who won't lead, but who will do what the majority wants . . . if anyone really knows what that is. When the ARRL proposed the plan to get 85% of the hams off phone, they claimed that only 20% of the members were opposed, so perhaps they were representing the majority. Since we have no elections in the ham field for leaders, all you are ever going to get are self-appointed ones. Now, if you want leaders without any ideas and with no interest in improving amateur radio . . . which is what you seem to be plugging for . . . by golly why not back all of those you see around? I opposed the ARRL plan to return to the prewar band system because I felt it would create severe problems . . . and I pointed them out. I did not oppose it as a representative of amateur radio or a leader presuming to represent the majority. In the present case, where I feel that we have had exhaustive proof that the code requirement does not keep out the severely psychotic and where there is a good reason to believe that a license based upon technical competence would clean things up, I am going to push for that, majority or no. I expect to find a wide variety of the confused, the apathetic, the psychotic, and reactionary hams fighting any changes. I also expect to find the more intelligent hams looking at the situation, weighing the evidence . . . and deciding that my ideas are worth a try. It would be difficult to have any new system tail worse than the one we have now. Charles, I have never been responsive to the majority and I'm not going to start now. When I perceived that FM and repeaters would be fantastic for amateurs I went ahead and published hundreds upon hundreds of articles . . . I published book after book . . . and held FM symposiums . . . plus a monthly repeater newsletter. The majority of hams hated it and raised hell over this. I stuck to my guns and today FM is the most popular aspect of amateur radio by far. Now the majority sees it my way . . . and perhaps now I am a leader in their eyes. Well, when I was one against the crowd, was I a leader then? You don't want a leader, you want a wishy-washy namby-pamby puppet and I wish you a lot of luck in finding one. Come to think of it . . . you won't have much trouble, for just such a sterling man seems to be in the offing. If you really want to be in the large group following a puppet, your opportunity is at hand . . . but leave me out of that.—Wayne.

HOOEY

In an effort to sell magazines and memberships, the ARRL drafted almost every CBer onto the ham bands. And now you want to drop the code requirements and draft everyone else, probably to sell magazines also. If the Aircraft Owner's and Pilot's Association took the same position, we would have the air space completely full of aircraft.

Mister Green, you need to understand that amateur radio is a hobby, not a business. And a *no-skills* license is not the answer to poor circulation. There are many hams that have dropped *73* (like myself) because of your "license everyone" position. In the future, I intend to plug you on the air and at meetings as the man who "sells magazines at the expense of amateur radio." Regrettably, your publication is a very good one. But it is not worth the damage you are doing to amateur radio.

"Butch" Rogers K3RYI
Wichita KS

Butch, you are full of guano. Oh, I've heard that brand of baloney before . . . about the crass commercial interests trying to get anyone and everyone into hamming in order to make dirty money. Well, it's hooey. ARRL did not draft CBers into amateur radio. If you would put what is left of your brain into gear you would recognize that anyone with any kind of an interest in radio communications . . . which is what I think we're looking for in hams . . . has to be a fruitcake not to try out CB for starters. If there had been anything like that when I got into ham radio, you can bet I would have been using it. So putting down someone for starting off with CB is ridiculous . . . a redneck reaction. No one that I've seen is trying to draft people for amateur radio with less abilities than now . . . indeed, it would be difficult to have a lower entry requirement than at present, considering some of the turkeys we have been getting into amateur radio of late . . . in case you've turned on a radio. I . . . and 73 Magazine . . . are proposing a much tougher type of license exam than at present . . . one which might keep some of the pigs out of the ham fraternity. I think we've seen more than enough proof that a code exam keeps out little and that some other means of separation of the sheep from the goats is needed. I believe that a technical exam, given by a ham club, one which follows a series of technical classes given by the club, will be a better system and will result in fewer obscene-mouthed nerds getting licenses. It is you who are doing the really serious damage to amateur radio . . . not those of us who are trying to clean it up by setting better standards for licensing.—Wayne.

NOT DUMB

I fully agree with you in reference to your editorial in December's *73 Magazine*. I would very much like to have a ham license but I have trouble with the code portion of the test. I do not consider myself a dumb person, but I seem to have a mental block concerning code. I have used your tape and others, but it seems that when I learn the sounds, I cannot get words out of them. Anyway, keep up the good work on *73 Magazine*, knowing that I for one will not drop my sub until your mag goes to all computers. I use computers in my work, but still do not own my own personal one. As I live 90 miles from Denver, I do not get even one television station and so subscribe to about 70 magazines at this time. I must say that the most-read and looked-at magazines are the ones put out by you. Keep up the good work.

You can also be sure of my support concerning a non-code license. Basically, I would like a license to be able to use ham radio in emergency situations. To be honest, the way the bands sound I do not have any interest in DX. It seems that most stations are interested only in a signal report and a QSL card. At least as far as US stations are concerned. In case you were wondering, I have a business license and so do use radio in the course of my everyday work—which is running a ranching business. Well, anyway, keep up the good work with your magazines.

David L. Andrews
Granby CO

David, a contact is whatever you make it. Whether you are talking on two meters, on 75 meters, or working DX, the type of contact is up to you. Oh, if you call in on a DX pileup or on a list operation, you know you are in for a QSL-type of contact. But if you are really interested in meeting people and talking with them, they are there, and they are as anxious to talk with you as you with them . . . if you give them the chance. I've had hour-long rag chews with even the rarest

of DX, finding things of mutual interest to discuss. I've found that most hams in rare spots are pathetically eager to talk. They are always running up against hams who want their QSL for a country, a prefix, etc., and it gets to be an expensive bore in a short while, driving many of them off the air. The more you can get into rag chews with these chaps, the more they will enjoy amateur radio . . . so you are performing a public service at the same time that you are enjoying yourself. You know, not every ham in the world lives and dies over the ARRL Honor Roll, or even over a DXCC certificate. Some are in it for the fun of talking . . . so give them a chance. You'll rarely hear me fighting the pileups. I tend to look for longer contacts, talking about how it is to live where they are, what there is to see, the skin diving, the photography, things like that.—Wayne.

WHERE'S ELMER?

As an aspiring Novice, I naturally subscribe to the better publications such as *73*. I read and re-read each issue, with the hope that I can somehow begin to make sense of some of the articles and projects. I have been a kit builder for years (Heath), and just recently I decided to venture again into the world of amateur radio.

While I have received much information from *73*, I think that many of the construction articles go right over the heads of the less sophisticated in electronics construction. Many of the equipment designs would be fantastic for the Novice just getting started, but the schematics scare them away. If the projects were presented with circuit board layouts with parts placement and wire directions, that would be a real boon to the Novice, both educationally and in the pocketbook.

There is one other problem that I would like to discuss with you briefly. As an "outsider" looking to get in, I have noticed a few idiosyncrasies of the amateur operator that perhaps have escaped the eye of those "inside."

I use the words "outsider" and "insider" because this is the way I have been made to feel by some of the amateurs I have come in contact with. They have made me feel as though my questions were stupid. They seem to lack the time to answer questions, and can't be bothered with a person who can't read schematics but only Heathkit™ diagrams. It would seem that unless you are a 25-wpm Extra with a 2-kW station with super quads, membership in clubs is discouraged.

Your editorial in the December, 1981, issue of *73* was of particular interest to me. You bemoan the loss of potential amateurs, the loss of new technical manpower, etc. You also stated that the youth of our nation should be made aware of the future in electronics and the fun of ham radio, through local clubs. This reminded me of when I was 16 and my imagination was first sparked by the lure of amateur radio. I was met with the same indifference as I am experiencing now, 20 years later. I had forgotten my bad experience and was just reminded of it recently when I again attempted to join the fraternity—or should I say clique.

I don't mean to sound negative, but it is easy to see why most potential Novices are turned away from amateur radio. The amateurs should be looking more to themselves rather than rattle sabers at the FCC. License requirements are tough, but not insurmountable. But if left to the clubs, I dare say even fewer would be licensed, at least through my experience, anyway. For the last 7 months I have been searching for that elusive "Elmer" I've heard about, who is always ready, willing, and able to lend a hand. Instead, I've received indifference, ambiguous information concerning membership in most clubs, infrequent or non-existent schedules for meetings, and what seems like a total lack of interest in helping a newcomer.

No longer a child, I refuse to give up this time. I'll make it on my own, through your excellent tapes and books. Maybe someday I can offer myself as an Elmer and perhaps revive what appears to be a lost tradition.

William J. Naughton, Jr.
Philadelphia PA

SURVIVAL

I have just finished reading Marvin Solomon WB8VNP's letter, "Survival," which appeared in the December, 1981, issue of *73*. I agree with his concern for the caliber and amount of scholastic training our children are receiving, but I think it goes further back than high school, all the way to our grade schools. Committed teachers are rewarded by moving them up into administration and replacing them with less competent educators who are interested only in the financial gains and not the education of our children. I'm not saying they are all like this, but the percentage of teachers who would rather promote a child with whom they had trouble instead of assuming the responsibilities of their jobs, namely to teach them the basics, is way too high!

I have a business where I'm in constant contact with children from grade school to college (I'm a barber) and it's amazing how many cannot even fill out a check properly, let alone do the basic fundamentals of math.

I have had a running battle with the school system here for almost twenty years, with four children in different levels of schooling. Sometimes I'm not sure whether I'm winning, but I urge every parent to be aware of the quality of schooling his children are receiving and if there is the smallest doubt that they are getting an adequate education, fight. Don't let them tell you what to do—you tell them. Otherwise the gap will get even wider.

Barry Vierra WB6GZK
Fair Oaks CA

You're right, Barry. Education has changed a good deal in the last 50 years. In the third grade I was taking courses in art appreciation, complete with the fundamentals of composition. This was invaluable to me when I got into photography . . . and later, when I went to work as a television cameraman, I was the only one in the crew who had had this sort of training. They taught us how to read music in the third grade, too . . . later valuable to me when I started singing in church and then in choruses. As far as I know, those subjects are long forgotten in most schools. Then there was a class in recognizing classical music, another one I'll bet they've stopped. That was in Brooklyn, New York, of all places . . . in the public schools. The art and music classes were in New Jersey. Later, in high school, the art classes were even better. My mother got so enthused by them when she went to the same high school that she went into art for a career. There is much to be done about education. If we can't get the schools to improve we still may be able to pull it together with video/computerized teaching systems which will be along in a few years.—Wayne.

CRIMINAL BAND?

After reading the letter by A. E. M. Spence VE7DKY, I felt compelled to voice my disagreement. First of all, I did not appreciate the insinuation that most of the lids on the air were from the 4th and 5th call areas. Since being licensed in 1976, I have heard very few hams from the 5th call area that would fall into the lid category. As for the New Mexico hams, I believe them to be of the highest caliber in the country.

The other statement that bothered me was the one on wanting the rest of the "Criminal Band" fraternity on the air. First of all, the proper name is "Citizens Band." Second, I as well as probably most of the amateurs don't want the average CB operator in the ranks, but there are a lot of CBers who would be an asset to the Amateur Radio Service. After all, they are humans just like everyone else, and everybody must start somewhere.

I got my start because of CB, and I don't consider myself a lid. I have an Advanced class license for which I *worked* very hard, and am into VHF, HF, and into the extra modes of RTTY and OSCAR. I am very active in building, and work with integrated circuits. I am also into computers.

Now, if it were not for CB, I probably would never have entered the world of amateur radio and electronics. Now, of course, I have a very marginal use for the Citizens Band radio service, but let us place credit where credit is due.

I do think that Mr. Spence should do a re-evaluation of the entire basis of his opinions.

Stan Gantz WB5TGL
Silver City NM

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

One of the most enjoyable and at the same time most rewarding aspects of writing this column is answering questions posed by readers. Because of the volume of mail received and my rather tight schedule, I am not always able to answer each one individually. Letters containing requests for a specific circuit or part are often unanswerable when received, and normally are held until such time as the requested information becomes available.

On the other hand, questions of general interest, such as those relating to RTTY principles or techniques, frequently wind up here in the pages of *73*. Not everyone is an expert, or even well versed, in everything. Questions from novice RTTY users as well as meaty tidbits from old pros provide an interesting and varied fare for the readership. Hungry? Let's see what's on today's menu.

Emil Guerrero, a "prospective ham" living in Portchester, New York, wants to add RTTY to his SWL (shortwave listening) shack. Emil notes that he is "no speed reader" and is interested in using a code converter to allow display of ASCII data on a Murray (Baudot) machine. Specifically, he asks about the feasibility of using a Murray printer running at 60 wpm (45.45 baud) to copy an ASCII transmission being sent at 150 or 300 baud.

Converting the eight-level ASCII to five-level Murray is no problem, Emil, and several hardware and software schemes have been covered in this column and within the pages of *73* over the past few years. The problem comes in when you try to build the reservoir.

"Reservoir," you ask? Well, it breaks down like this. ASCII transmission coming in at 300 baud, the most commonly used speed, represents about 30 characters every second. In, let's say, the first minute, that represents about 1800 characters. On the receiving end, that teleprinter is able to handle five-level input at 45.45 baud, which represents about six characters per second, or about 360 characters per minute. Not counting slop-over, this represents about 1440 characters per minute that must be stored. In a ten-minute broadcast, you would have to provide a reservoir, such as with a computer-style read/write memory, of some 14,400 characters. That's roughly 14 kilobytes! Now you need some means of stuffing data into that memory, pulling it out, keeping track of where you are, and doing a code conversion (ASCII to Murray, remember?) all at the same time. You need a computer.

Now, it can be done, and certainly individual characters can be converted from one code to another without all this hassle. But in order to receive automatic transmission, that is, transmission at machine speed, a buffer and some machine "smarts" are needed. Hopefully, some of the articles published in the past will help.

Emil is not alone, by the way. A similar letter was received from Larry LeMone K7IHI, out in Provo, Utah, who is also interested in such a conversion scheme.

Along the same line, but with an interesting variation, comes a letter from Curt Heuberger K1CH in Seekonk, Massachusetts. Curt is interested in using an IBM Selectric® typewriter for a RTTY I/O device. I see no reason why such a code conversion could not be implemented using a Murray-to-correspondence scheme similar to those which implement ASCII on the Selectric. I am using such a scheme here with an unpublished program that turns an I/O Selectric into a "smart" printer. It would be simple to take a scheme like that and change the code tables to convert to Murray rather than ASCII. Curt mentions that he has the "fixin's" for a small Z-80 computer sitting on the shelf. Either that or a small single-board computer like the "Kilobaud Klassroom Komputer" described here a few months back would be ideal to implement a RTTY Selectric system.

Emil, along with Richard Flink WB2SOU, out in Hillsdale, New Jersey, wonders about where to find stations broadcasting weather or press information. I again refer to Tom Harrington's book, *World Press Service Frequencies*, available from the *73* Radio Bookshop for $5.95 (order book number BK1202). This book, along with its periodic updates, comprises one of the most complete listings I have seen and includes a wide spectrum of international RTTY stations. It is, by the way, only one of the good books to be found on a tour through the Bookshop.

Merging computers and RTTY continues to be a popular topic. George Gadbois W3FEY is confused as to why, with several of the schemes I have described to input RTTY into a 6800 computer, I have resorted to a software UART rather than configuring the serial port into the five data bits needed for Murray code.

Well, George, this all relates to the type of chip used for input into this series of computer. Rather than a general-purpose UART, the 6800 series of computers—that is, most computers based on the Motorola M6800 CPU—commonly use a Motorola 6850 ACIA (Asynchronous Communications Interface Adapter) chip. The ACIA is more "powerful" than a UART in that it allows more control to be passed in and out of the computer and interfaces with the bus and serial communications line very well, but lacks the ability to be configured in other than a seven- or eight-bit format.

It is this failing, as it were, that forces us into using an alternate scheme, other than the serial ACIA, that is, to input five-level Murray into a 6800 computer. There are two ways to go. Either use a UART, which means building an interface board and software, or use a parallel port, which involves only new software. For a frugal fellow like me, the "software UART" is the logical choice.

Once selected, the software approach suddenly offers all kinds of other advantages. Speed changing or code changing is trivial to accomplish. Auxiliary lines are available to key the transmitter, turn on lights, or brew the coffee. All kinds of nice things fall into place, and you even save a few bucks: Neat!

It is for this reason that another scheme, posed by Paul Pennington of Martinez, Georgia, will fall through. Paul is using an SWTPC 6800 computer with a video board display and a modem connected to the computer's former input board, an ACI-based interface. Paul feels that feeding receiver audio into the modem and then through into the ACIA for input would be a viable way to implement RTTY on a shoestring.

There are a few problems with this idea, no matter how attractive it seems. First of all, the common modem receive frequencies in originate mode, the "normal" state of affairs, are mark = 2225 Hz and space = 2025 Hz. Contrast this to the RTTY "standard" of mark = 2125 Hz and space = 2975 Hz used on VHF links. Not only is the degree of shift different (200 Hz vs. 850 Hz), but the direction is wrong also. Now, if you were on HF and used the wrong sideband to tune in a 170-Hz shift signal, you might get the modem filters to recognize the signal, but then another problem arises.

The usual mode of transmission on amateur circuits is still five-level Murray, and here you are with that ACIA board just as tied as ever to seven- or eight-bit codes. Sorry! I am afraid that you would either be limited to receiving ASCII or would have to replace the ACIA with a UART in order to input the Murray code unmolested. As a kluge you could try to interface the modem to the one-bit parallel port software UART we have been talking about, but I can't recommend that.

The other problem is in using that modem itself. The extra bucks that a RTTY demodulator costs buy quite a bit in selectivity, function, and features when compared to a landline-style modem. You might look into a small demodulator, such as the iRL FSK-500 highlighted here a few months back, to complete a RTTY station at minimal expense.

Boy, this has been a depressing column, so far! All I have done is tell this fellow or that one that this scheme or that will not work. How about something encouraging?

Nicholas Oland W3DSE of Reading, Pennsylvania, is looking for a way to convert a surplus ASCII video terminal to Murray. Nick states that he is

not looking for buffers or other bells and whistles, but just for a straight ASCII/Murray scheme for manual operation.

Well, as long as the display terminal is able to operate faster than the input, as it would be with a 300-baud terminal receiving 45.45-baud code, the reservoir problem detailed above would not be a factor. Similarly, I presume few of us can type at machine speed for any length of time, and if you can, you could not go any faster on an old Model 15, so let's accept that constraint also. Fig. 1 is a block diagram of what you need, a simple hardware ASCII-to-Murray duplex converter. Several such schemes have been published in *73 Magazine* in the past.

Nick also relates difficulty in finding specialized chips, UARTs, and the like needed for building projects such as this. I have found that most of the firms who advertise right here in *73* do a fine job of providing just about any imaginable part. When I have needed a particular chip or part that is not listed in their ads or catalogs, a phone call or letter to selected firms will usually turn up one able to supply the item from stock. Not all stocked items are able to be listed, you know.

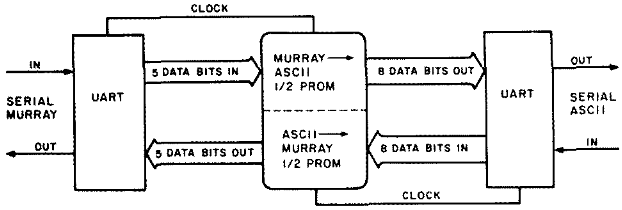


Fig. 1. ASCII/Murray conversion block diagram.

Above all, know the firm with which you deal, either through a friend's recommendation or with the endorsement of the publisher of the ad. Don't send cash through the mails, and keep a copy of your order should problems develop later.

Next month is April, and every year at this time I get the urge to write something, shall we say, unique. Want to find out? Don't miss next month's RTTY Loop!

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

cians, and electronics experts. Well, the recent emphasis on skipping theory in the getting of a ham ticket, with the use of the ARRL Q&A and Bass cheat books instead of an understanding...using only an ability to copy code as the filter...has reduced our ranks to a mere handful of technicians and electronics experts. By using the code as the only serious test...if you can call five words per minute serious...and throwing out any real need for technical knowledge, we have thrown out most of our value to the country...and to ourselves.

Yes, a few of you reading this have taken the trouble to use the *73* license study course and you have a good understanding of the fundamentals of electronics. You are in the minority, sad to say. And how many clubs take a half hour or so at the beginning of their meetings to run through some aspect of radio or electronics theory? Maybe a dozen out of several thousand.

Reservoir of operators? Sure, but for what? Not for any military need today. The military rarely uses code today. They use phone for local communications and automatic encrypted systems for longer ranges. Fortv years ago, it took a few months to train a ham to be of value to the armed forces. During WWII, 80% of the hams went into the services and helped out... mostly as technicians, not as Morse operators. That was before RTTY was really invented. Once that was an accomplished fact, the use of Morse virtually disappeared. Today, with computers so small you can carry them in your shirt pocket, no one needs a hand key or an old Teletype™ clunker. Computers can be used to write messages and then they can be plugged into a communications system and the message can be transferred almost instantly, anywhere.

Indeed, I've recently written about a system which I suggest that amateurs start developing, using currently-available technology and equipment, which would allow us to communicate at 8,500 words per minute. With some encoding, that can be upped to 26,000 words per minute.

Some reservoir we are at present! It could take a couple of years to train hams to cope with today's military technology.

Okay, on to 97.1(e), the last of the reasons for amateur radio to exist as a service. International goodwill. Boy, can we stand to do some work on *that* one. I suppose there are a few ops in foreign countries who feel goodwill when dumped on by a pileup... damned few. And how many of the DX ops really enjoy our 5,000-Watt Honor Roll (the irony of *that*)—ops wiping out every new and rare country which comes on the bands? Is it going to be claimed that an exchange on CW of signal reports and a handle are really generating goodwill? Don't make me laugh so hard that I break open my 40-year-old appendix scar.

Look here, don't get mad at me for simply stating the facts of life. If you don't like the facts, do something to change them ...don't beef at me for having the gall to state the obvious.

Now, you are not going to have any problem finding a whole raft of hams who swear by the Morse code...which I admit is extremely useful when you want to blink your eyes in code (would it be faster in ASCII?). But how many of you are going to try to tell me that you honestly believe that the code requirement has kept out the dingbats? Brother, we are up to here in psycho cases, so don't tell me about keeping out the undesirables. When I see four-year-old kids passing the code test and getting a ham ticket, I have trouble not being terminally sarcastic when I hear claims about it keeping our bloodline pure. If you are lucky enough to be in an area where two meters is sane, please get Bill Pasternak to send you some tapes of two meters in Los Angeles. You'll never be the same. A zoo.

And I'm getting a little sick of hearing that I am for opening the floodgates to the loonies. Those gates have been open for years. I'm for making amateur radio a technical hobby...with required courses in theory given by clubs...and damned good exams given by the same clubs. Maybe we can stem the tide of CB outcasts.

By golly, *that* felt good. Well, now back to being mild-mannered, lovable old Wayne Green.

CODE COURSES THE PITS

A recent call from Larry Horne, who runs a school in New York which teaches code in a matter of a few days, preparing people for their ham tickets, brought out that tests of the many code cassette courses on the market had shown most of them to be disasters. One of the very worst, oddly enough, was one of the best selling, put out by a national ham organization. And, yes, the organization knows that the course is bad and is losing us hams by the tens of thousands, but apparently it feels that it is too much trouble to change it... and, after all, it is selling well. Dealers, interested in making a buck any way they can, allow this travesty to be sold. Pity, when there *are* some very good code courses available.

Larry is running some tests for the Coast Guard to show them how fast some of the modern systems are...systems such as the *73* Code Course. The Coast Guard, which I understand has been quite hostile to amateur radio in the past, has been putting their trainees through a five-month, forty-hour-a-week course in which about 20% get to a speed of 18 wpm. Then, after a year on the job, another 20% qualify for 18 wpm.

60% wash out. So much for the old code-teaching system.

Would you believe that it is possible to start rank beginners out at 20 wpm? In fact, tests are being made at 35 wpm for starters...yes, from the very start. And the tests are very promising. It seems it is no more difficult to get the feeling of the pattern of a character at 35 wpm than it is at 5 wpm. Better; instead of setting up a lookup table in one side of the brain and transferring the sound pattern from the other half of the brain for comparison, everything is done in the same side of the brain. This avoids the old plateau syndrome...a disaster which has washed out hundreds of thousands of prospective hams.

Tentative tests seem to indicate that women, in particular, benefit from this avoidance of the left to right to left brain-shuffle problem. Perhaps it is the more intense competitive dedication of men that finally overcomes this mess rather than anything inherent. At any rate, setting up a learning system which uses one side of the brain only cuts the learning time to shreds, avoids much of the agony and sweat, and almost guarantees 100% success for anyone trying. It's almost fun...but not quite.

I'd like to see how far this concept can be carried. I don't see any reason why code can't be taught using this system and starting out at 50 wpm...and possibly even up to 100 wpm. Once you stop having to send the signals back and forth through the slow brain circuits and set up an operation which is largely done in the super-fast subconscious part of the brain, we're not sure what speed can be attained.

So, if you are asked about code-learning systems by newcomers, their fate is in your hands. You can recommend the best sellers...and doom them, for the most part...if not to failure, at least to agony. Or you can give them a real boost by recommending one of the only two (as far as I know) courses on the market which train the brain for automatic character recognition. That's the *73* Blitz Code Course.

IT'S UP TO US!

Don KA7DTP sent me a copy of an article from *Science* which said that the government has now terminated all efforts at listening for alien radio messages. The $2M a year program was shot down by Senator Proxmire, saying that, "It's hard enough to find intelligent life here In Washington."

NASA scientists were building a multichannel spectrum analyzer to detect non-random signals from space. That's down the tubes now and, according to a scientist from Stanford University, "The important contacts with extraterrestrial life will be left to radio hams." That's hardly a mandate, but if any readers are interested in pursuing the project, I can assure you that *73 Magazine* is most interested in providing the needed communications via articles and news.

What a pity that Sam Harris W1FZJ/KP4, who was a scientist on the big dish at Arecibo, isn't around to help get this started. Sam was one of the real ham inventors and pioneers...which is how he got the job at the research laboratory in the first place. It was Sam who built the first working parametric amplifier. He built it at home for use on six meters, and when I published the article on it most readers thought it was a humor piece. Who ever heard of feeding an oscillator into an amplifier?

As a piece of further bad news for VHF old-timers, Sam's wife, Helen W1HOY, a true pioneer on six meters, passed away a few weeks ago. She was living in Puerto Rico in Arecibo. Both Sam and Helen will be missed by all of their friends...and by future hams who will not benefit from the many inventions that Sam might have produced if he had lived.

Getting back to listening for signals from space...I'm interested in some articles on this and perhaps an organization of ham pioneers to systematically scan space for coherent signals. With the recent progress in digital circuits, we should be able to come up with some relatively inexpensive circuits for detecting non-random signals. The next step is to choose the best frequencies...get all of the help from the satellite TV technology we can for dishes, low-noise front ends, downconverters...and start listening.

NASA and Senator Proxmire...I say that amateurs accept the challenge. Now, let's hear it from those readers who want to be involved with this project.

OSCAR ORBITS

The tables of orbital information for OSCARs 8 and 9 were prepared with the assistance of Project OSCAR, Inc., PO Box 1136, Los Altos CA 94022. Due to the low orbit of OSCAR 9, its orbit is changing rapidly, making accurate long-range orbital predictions very difficult. Therefore, the OSCAR 9 information in these tables may be in error by several minutes and several degrees of longitude.

OSCAR 8 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
20319	1	0106:11	85.3
20333	2	0110:42	86.4
20347	3	0115:13	87.6
20361	4	0119:44	88.8
20375	5	0124:15	89.9
20389	6	0128:46	91.1
20403	7	0133:17	92.2
20417	8	0137:48	93.4
20431	9	0142:19	94.6
20444	10	0003:39	69.9
20458	11	0008:10	71.1
20472	12	0012:41	72.2
20486	13	0017:12	73.4
20500	14	0021:43	74.6
20514	15	0026:15	75.7
20528	16	0030:46	76.9
20542	17	0035:17	78.0
20556	18	0039:48	79.2
20570	19	0044:19	80.4
20584	20	0048:50	81.5
20598	21	0053:21	82.7
20612	22	0057:52	83.8
20626	23	0102:23	85.0
20640	24	0106:54	86.2
20654	25	0111:25	87.3
20668	26	0115:56	88.5
20682	27	0120:27	89.6
20696	28	0124:58	90.8
20710	29	0129:29	92.0
20724	30	0134:00	93.1
20738	31	0138:31	94.3

OSCAR 9 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
2199	1	0009:45	132.1
2215	2	0132:56	152.7
2230	3	0120:54	149.5
2245	4	0108:58	146.4
2260	5	0056:45	143.2
2275	6	0044:39	140.0
2290	7	0032:32	136.8
2305	8	0020:23	133.6
2320	9	0008:13	130.4
2336	10	0131:13	151.0
2351	11	0119:01	147.8
2366	12	0106:47	144.6
2381	13	0054:32	141.3
2396	14	0042:16	138.1
2411	15	0025:58	134.8
2426	16	0017:40	131.6
2441	17	0005:20	128.3
2457	18	0128:09	148.8
2472	19	0115:46	145.5
2487	20	0103:23	142.3
2502	21	0050:58	139.0
2517	22	0038:31	135.7
2532	23	0026:04	132.3
2547	24	0013:35	129.0
2562	25	0001:05	125.7
2578	26	0123:43	146.1
2593	27	0111:11	142.8
2608	28	0058:37	139.4
2623	29	0046:02	136.1
2638	30	0033:25	132.7
2653	31	0020:48	129.3

THE RUSSIAN SATELLITES

The last days of 1981 were exciting ones for amateur satellite fans. On December 17, the Soviet Union simultaneously launched six new Radio Sport (RS) amateur radio satellites, designated RS-3 through RS-8. The new birds were placed into orbit by a single launch vehicle and each takes about two hours to orbit the Earth. Although they are in similar orbits, the RS satellites are by no means identical, and some of them have quite unique capabilities. Below is a brief description of the various features. Tables 1 and 2 summarize some important information for each satellite.

Beacons

Each satellite has one or more 10-meter beacon frequencies, as

OSCAR 8 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
20752	1	0143:02	95.4
20765	2	0004:23	70.8
20779	3	0008:54	72.0
20793	4	0013:25	73.1
20807	5	0017:56	74.3
20821	6	0022:27	75.4
20835	7	0026:58	76.6
20849	8	0031:29	77.8
20863	9	0036:00	78.9
20877	10	0040:31	80.1
20891	11	0045:02	81.2
20905	12	0049:33	82.4
20919	13	0054:04	83.6
20933	14	0058:35	84.7
20947	15	0103:06	85.9
20961	16	0107:37	87.0
20975	17	0112:08	88.2
20989	18	0116:39	89.4
21003	19	0121:10	90.5
21017	20	0125:41	91.7
21031	21	0130:12	92.8
21045	22	0134:44	94.0
21059	23	0139:15	95.2
21072	24	0000:35	70.5
21086	25	0005:06	71.7
21100	26	0009:37	72.8
21114	27	0014:08	74.0
21128	28	0018:39	75.2
21142	29	0023:10	76.3
21156	30	0027:41	77.5

OSCAR 9 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
2668	1	0008:09	126.0
2684	2	0130:38	146.4
2699	3	0117:56	143.0
2714	4	0105:14	139.6
2729	5	0052:30	136.1
2744	6	0039:45	132.7
2759	7	0026:58	129.3
2774	8	0014:10	125.9
2789	9	0001:21	122.4
2805	10	0123:40	142.7
2820	11	0110:48	139.3
2835	12	0057:55	135.8
2850	13	0045:01	132.3
2865	14	0032:06	128.9
2880	15	0019:09	125.4
2895	16	0006:12	121.9
2911	17	0128:21	142.1
2926	18	0115:20	138.6
2941	19	0102:19	135.1
2956	20	0049:16	131.6
2971	21	0036:11	128.0
2986	22	0023:06	124.5
3001	23	0009:59	121.0
3017	24	0131:59	141.2
3032	25	0118:50	137.6
3047	26	0105:39	134.0
3062	27	0052:27	130.4
3077	28	0039:14	126.9
3092	29	0026:00	123.3
3107	30	0012:45	119.7

BEACON AND ROBOT FREQUENCIES
(MHz)

Satellite Name	Beacon Frequency	Robot Uplink	Robot Downlink
RS-3	29.320	—	—
RS-4	29.360	—	—
RS-5	29.450	145.830	29.330
RS-6	29.450	—	—
RS-7	29.500	145.840	29.340
RS-8	29.500	—	—

Table 1.

COMMUNICATION PASSBANDS
(MHz)

Satellite Name	Uplink Passband	Downlink Passband
RS-5	145.910-145.950	29.410-29.450
RS-6	145.910-145.950	29.410-29.450
RS-7	145.960-146.000	29.460-29.500
RS-8	145.960-146.000	29.460-29.500

Table 2.

shown in the Table 1. When you hear one of the RS satellites, the frequency of the beacon can be a guide as to which bird it is. The beacon frequencies of RS-5 and RS-7 change when the satellite is in the "robot" mode. See below.

The beacons transmit telemetry information in a coded format. The information is sent in Morse Code at 20-30 words per minute. Each telemetry frame consists of the satellite identifier plus seven pieces of data. A typical telemetry frame might consist of "RS5 K00 D00 O76 G00 U00 S15 W17." As this is being written, the only channel thus far interpreted is the K channel, which indicates the output power of the transponder. When the value for K is 00, as in the example above, this means that the satellite's transponder is presently turned off. A K value other than 00 indicates that the transponder is in operation.

Transponders

At press time, RS-5, 6, 7, and 8 were known to contain transponders for two-way communication. These operate in Mode A, which means you transmit to the satellites on 2 meters between 145.910 and 146.000 (the uplink), and listen for returning signals on 10 meters just below the beacon frequency (the downlink). Table 2 summarizes the transponder uplink and downlink frequencies.

Since a popular class of Soviet amateur license allows only low-power operation on VHF, these latest birds have very sensitive receivers. Therefore, it is recommended that you use no more than 10 Watts effective radiated power (erp) when attempting to communicate through the RS satellites.

Robots

The most unusual feature of the new RS satellites is the "robot," an automatic CW QSO device present on RS-5 and RS-7. When operating, the robot calls CQ on one of the beacon frequencies and then listens for amateurs to respond on a specific 2-meter frequency. If you make the proper response, the robot then sends a short confirmation message containing your callsign, assigning a number to your contact, and thanking you for the QSO.

If I am trying to work the RS-5 robot, for instance, the response expected by the robot is "RS5 DE WB8BTH AR" or "RS5 DE WB8BTH AR K" (it's not yet clear if the final "K" is necessary). Of course, you must substitute your own callsign as well as send the proper satellite identifier. If the robot has copied your complete response correctly, it will confirm the contact by sending "WB8BTH DE RS5 QSO NR XXX OP ROBOT TU FR QSO 73 SK." The XXX is a serial number assigned by the robot to your QSO. Sometimes the robot will "listen" to several callers and then send several confirmation messages in succession.

The uplink frequencies for robot operation are given in Table 1. The best success has been achieved when transmitting slightly (perhaps 4 kHz) below the frequencies in the table. Sometimes the beacon and robot frequencies are interchanged, so be sure to tune around.

Experiments

According to the Soviets, RS-3 and RS-4 are intended for experimental use, explaining why no transponder or robot activity was heard on these satellites during their early life. By the time you read this, these two satellites may have produced some surprises.

Orbital Parameters

The first rough estimates for the orbital periods of the new satellites range from 118.52 minutes for RS-3 to 119.77 minutes for RS-8. The corresponding per orbit longitude increments vary from 29.76 to 30.07 degrees. When the six satellites were first launched, they were quite close together. However, since they are in slightly different orbits, they quickly began to drift away from one another.

Summary

The new RS satellites are very easy to hear. In the mid- to late evening, and again in the late morning hours, the six satellites have been solid copy, even on inexpensive shortwave receivers. A dipole or other simple 10-meter antenna will be perfectly adequate for good reception.

At this writing, the new satellites were only two weeks old, and their orbital parameters were not known with sufficient accuracy to permit the preparation of reference orbit tables, such as those published for OSCARs 8 and 9. More up-to-date information on the RS satellites can be found in ARRL bulletins and on the various AMSAT nets. Thanks to WB1EYI and W9KDR at the ARRL for their assistance in providing information used in this article. —WB8BTH.

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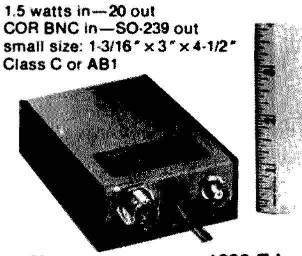

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HAM HELP

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Marvin Rosen N3BQA
20 W. Madison St.
Baltimore MD 21201
(301)-685-6308

I am looking for a vfo to accompany my Hallicrafters SR-42 receiver.

Ben Kronnick WB6REN
2539 Thayer Court
Riverside CA 92507

I am in need of a copy of the owner's manual and schematic for a Robyn MT701 CB transceiver tester.

S.E. Hess W7CW
6540 Chico Way N.W.
Bremerton WA 98310

I would like to hear from old members of the 136th Radio Intelligence Corps, especially those operating at Section Eight: Nadzab, Hollandia, Leyte, and Tokyo.

Donald E. Head K8NCZ
8190 Wright Road
Broadview Heights OH 44$47

I am in need of an assembly manual for a Knightkit dc oscilloscope, model KG-635. I will copy and return your original.

R. Weinberger KB6TI
14130 Alta Vista
Saratoga CA 95070

I am looking for a used communications service monitor, preferably a Cushman or IFR.

Tommy S. Evans NE4J
401 East Vance St.
Wilson NC 27893

I am in need of a schematic and instruction manual for a Gonset G-151 FM Communicator.

James Leathem K7BTB
48 Pine Cone Dr.
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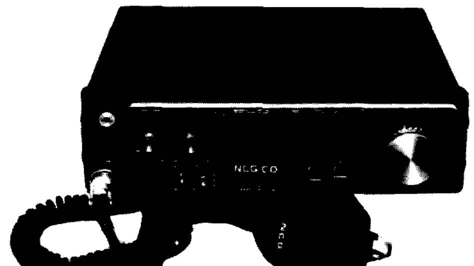

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DX

AMATEUR RADIO IN PARADISE

Cook Islands certainly has a lot to offer the traveling ham. There are only twenty-five amateurs, and its Prime Minister, Tom Davis ZK1AN, is very active on the air. It is an excellent location for working all types of DX, and when you are operating from there, you are rare DX yourself.

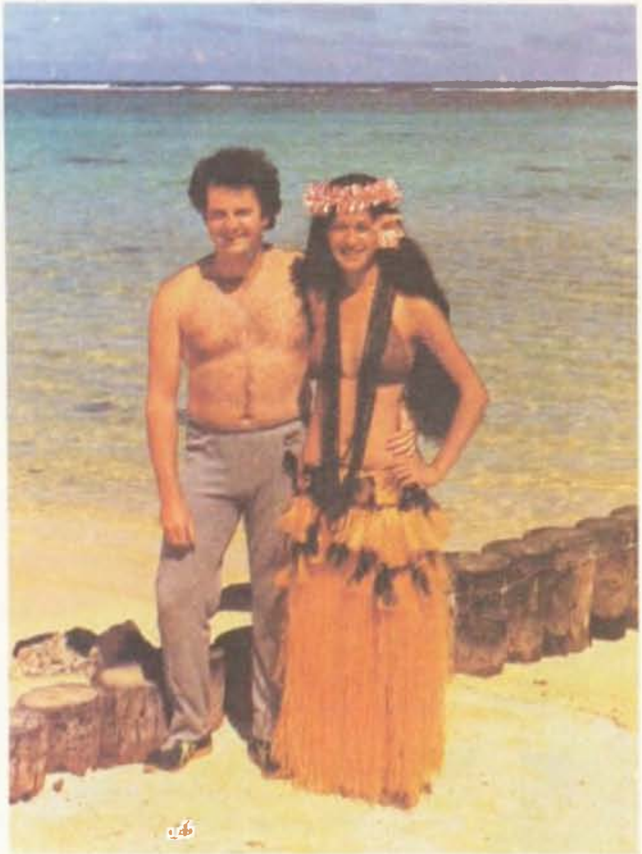
If the Cook Islanders are not already famous for their friendly, hospitable ways, it is only because the world has seen so little of them. Long isolated from major travel routes and today's world of bustling cities and crowded beaches, the islands which make up the self-governed area of Cook Islands are possibly the last unspoiled discoveries in the South Pacific.

The fifteen islands that comprise Cook Islands lie scattered over 751,000 square miles of the Pacific to the northeast of New Zealand. There are two distinct groups, the Northern and the Southern.

In the north lie the islands of Penrhyn, Nassau, Pukapuka, Manihiki, Rakahanga, and Suwarrow. All except Nassau are coral atolls. Amateur radio activity there is sparse, often only from visiting hams sent for research or for United Nations work. At the moment, there are no permanently active hams in the Northern Cooks. I was recently on Manihiki Atoll for two weeks and made seventy HF contacts. Unfortunately, however, Murphy struck in the form of two large lizards which shorted out the rectifier board and the power transformer in my Kenwood 530S transceiver, limiting the number of radio contacts that I could have. (I will be making another trip shortly and hope this time to have a spare rig available.)

The Southern Group consists of two atolls, Palmerston and Manuae, and seven islands. These are Mangaia, Aitutaki, Atiu, Mauke, Mitiaro, Takutea, and the largest island and capital, Rarotonga, the most developed of all of them, although it is only twenty-five square miles in area.

Rarotonga is a fertile island with the breathtaking scenic beauty of white sand beaches and a sparkling clear lagoon. It has spectacular rugged mountain peaks together with a warm tropical climate perpetually tempered by the soft, cool, southeast trade winds. The highlands are mainly covered with tropical evergreen forests while the lowlands and valleys are used for planting.



The author and a Cook Islands friend.

Cook Islands, with a population of eighteen thousand, is virtually bereft of natural resources and is dependent for its livelihood mainly on overseas trade. It imports over fifty percent of its food, all of its raw materials, plant machinery, and oil, the main source of energy in the islands. The main exports are bananas, copra, and canned orange and pineapple juices. It is completely self-governing, with an elected Prime Minister and legislature.

All electricity in the islands is produced from oil imported from Fiji, and, like most other developing countries, Cook Islands is simply reeling under the burden of vastly higher energy costs and increasing food prices.

Amateur radio equipment for use in Cook Islands has a twenty percent customs duty levied upon it. In the case of an amateur bringing his own equipment for his own personal use, no duty is paid as long as the equipment leaves the country with the foreign ham. Local ac voltage is 240 volts, 50 Hz. The license fee is NZ$6.00 per annum and is issued upon presentation of a copy (or the original) of your home station license. A very quick way of obtaining a ZK license is to forward full particulars to Miss Jane Amoa, PO Box 243, Rarotonga, Cook Islands, South Pacific.

Miss Amoa also runs an excellent service for the visiting amateur. This service provides a beach house complete with all the latest radio gear including

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antennas for all bands, a housemaid, and car or bike rental, all for a very reasonable cost. In addition, portable generators with multi-voltages, transceivers, and antennas all can be hired by the more adventurous ham who wants to stage his own DXpedition to the outer or Northern Group of islands.

There are no television transmissions in Cook Islands, but there is an FM broadcast station on 103 MHz. Radio Cook Islands broadcasts on shortwave—11760 kHz, and ZK4 and 1ZC on medium wave—630 kHz.

Stuart Kingan ZK1AA handles all of the interisland telephone patching, using modified amateur equipment. Transmissions are on 4038.00 MHz USB from 1800 hours GMT for the Southern Group. Northern Group transmissions are on 12214.00 MHz USB from 2000 hours GMT. His callsign for this network is ZKA2. He is also in charge of the PEACESAT network, transmitting as ZK1XA Rarotonga on satellite frequency 149.220 MHz and receiving on 135.600 MHz from 0200 hours GMT. He uses very modest circularly-polarized antennas with 150 Watts output, which give excellent results. The network is in use daily.

Shortage of equipment and trained personnel to teach local youngsters about amateur radio and electronics is the main reason why so few new licenses are being issued.

If you ever have the chance to visit Cook Islands, I strongly suggest you take out a license and operate, as conditions are excellent to all parts of the world. The local people are friendly and very helpful.

Kia Orana!

James Goodger ZK1DG
PO Box 64
Rarotonga, Cook Islands
South Pacific

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

QCWA QSO PARTY—PHONE

Starts: 0001 GMT, March 13
Ends: 2400 GMT, March 14

This is the second weekend of the 25th annual QCWA QSO party. Contacts with the same station on more than one band can be scored only once. Contacts made with "captive" stations, such as those operating in local nets, are not valid.

EXCHANGE:

QSO number, operator's name, and QCWA chapter identification (official number or name). Members not affiliated with a chapter should use "AL".

FREQUENCIES:

Any authorized amateur frequency is permissible. The following suggested frequencies have been selected to minimize interference to others: 3900-3930, 7230-7260, 14280-14310, 21350-21380, and 28600-28630. The above frequencies are selected as a starting place. When pileups occur, don't be afraid to go to either side of these frequencies.

SCORING:

Each contact made with another QCWA member will count as a single point. This year's contest has two multipliers. The first is the same as in years past: Each chapter is a multiplier of one. The second is that DX stations are a multiplier of two. DX stations are defined as Europe, Africa, South America, Asia, and Oceania—the same as for WAC of ARRL. Contacts within your own country count only as a chapter multiplier. Final score is then the total QSO points times the sum of the number of chapters and DX stations worked.

AWARDS:

Plaques for the top phone and top CW scorers. Certificates will be given for the 2nd through 5th runners-up in both the phone and CW parties. Standings and scores will be published in the *QCWA News* (summer, 1982, issue).

ENTRIES:

Logs should include the following information: time (GMT), call, QSO numbers, name, chapter number or name, and state or country. It is the responsibility of each contestant to provide a legible log (no carbon copies) and to list all claimed contacts. The total contacts for each page will be recorded at the bottom of each page. The total contacts for the party should be recorded at the top right of the first page of the log. Log sheets will not be returned. Make sure you have correct postage when you mail your logs. Send logs not later than March 31st to: Pine Tree Chapter #134, Glenn Baxter K1MAN, Long Pond Lodge, Belgrade Lakes ME 04918. Separate logs and scores must be submitted for both the CW and phone parties. Work as many QCWA members as possible and apply for any of the special QCWA certificates which you may have qualified for: Worked 50 States, Worked 60 Chapters, Worked 100 Members, and/or Worked 500 Members.

RSGB COMMONWEALTH CONTEST

Starts: 1200 GMT, March 13
Ends: 0900 GMT, March 14

This contest is open only to members of the RSGB resident in the UK, and radio amateurs licensed to operate within the British Commonwealth or British Mandated Territories.

The general rules for RSGB HF contests, published in the January, 1982, issue of *Radio Communication*, will apply. This contest is a single-operator, single-transmitter event. Evidence of simultaneous operation on more than one frequency may result in disqualification.

Also, all contacts must be on CW only. Contacts may be made with any station using a British Commonwealth callsign, except those within the entrant's own call area. UK stations may not work each other for points.

EXCHANGE:

RS(T) plus serial number starting at 001.

FREQUENCIES:

CALENDAR

Mar 6-7	**ARRL DX Contest—Phone**
Mar 13-14	**QCWA QSO Party—Phone**
Mar 13-14	**RSGB Commonwealth Contest**
Mar 20-21	**YL ISSB QSO Party—CW**
Mar 20-22	**BARTG Spring RTTY Contest**
Mar 27-28	**Spring VHF/UHF QSO Party**
Apr 3-4	**CW & RTTY World Championships**
Apr 17-18	**ARCI QRP Spring QSO Party**
Apr 24-25	**YL ISSB QSO Party—Phone**
Jun 12-13	**ARRL VHF QSO Party**
Jun 26-27	**ARRL Field Day**
Jul 10-11	**IARU Radiosport**
Jul 17-18	**International QRP Contest**
Aug 7-8	**ARRL UHF Contest**
Aug 14-15	**European DX Contest—CW**
Sep 11-12	**ARRL VHF QSO Party**
Sep 11-12	**European DX Contest—Phone**
Oct 16-17	**ARCI QRP CW QSO Party**
Nov 6-7	**ARRL Sweepstakes—CW**
Nov 13-14	**European DX Contest—RTTY**
Nov 20-21	**ARRL Sweepstakes—Phone**
Dec 4-5	**ARRL 160-Meter Contest**
Dec 11-12	**ARRL 10-Meter Contest**

RESULTS

RESULTS OF WASHINGTON STATE QSO PARTY FOR 1981
sponsored by
Boeing Employees' Amateur Radio Society (BEARS)

Alabama	*K4ZGB	91	29	5,829
Alaska	*NL7D	38	15	1,140
Arizona	*W7ZMD	152	38	15,352
Arkansas	*KE5B	122	31	9,517
California	*N6PE	190	42	19,740
Colorado	*NØCKC	25	13	975
Connecticut	*W1TEE	76	29	6,061
Florida	*WA4FNA	43	17	2,196
Georgia	*KA4BYS	67	24	3,264
Idaho	*KA7LBA	8	7	112
Illinois	*WB9TBU	101	27	6,804
Indiana	*KI9U	212	46	23,368
Iowa	*WAØVBW	29	16	1,024
Kansas	*WDØCCW	46	21	1,932
Kentucky	*N4FCE	21	13	546
Maine	*K2QE/1	75	28	5,376
Maryland	*N3AC	21	11	506
Massachusetts	*W1AQE	50	26	3,900
Michigan	*W8WVU	53	24	3,816
Minnesota	*WBØLNO	44	18	1,584
Missouri	*KØTBB	41	19	2,242
Montana	*N7ATT	9	7	126
Nebraska	*WØJJL	25	12	660
New Jersey	*W2CC	5	5	50
New York	*WB2NDE	107	33	7,062
North Carolina	*KB4GZ	13	8	208
North Dakota	*NØCZO	9	5	90
Ohio	*N8FU	71	25	3,975
Oklahoma	*N5AFV	39	15	1,170
Oregon	*WA7RQS	56	18	2,070
Pennsylvania	*AD8J/3	49	19	2,147
South Dakota	*WAØBZD	16	10	320
Tennessee	*WA4CMS	45	20	2,180
Texas	*W5OVU	82	26	4,264
Utah	*W7LN	27	10	800
Vermont	*N1BRT	10	6	120
Virginia	*K4OD	60	22	3,344
West Virginia	*KD8K	48	19	2,090
Wisconsin	*K9GDF	107	34	9,350
CANADA				
British Columbia	*VE7AVN	39	21	1,638
Manitoba	*VE4RF	51	22	3,058
Ontario	*VE3KK	70	27	5,670
BRAZIL	*PY1NEZ	20	8	320
ENGLAND	*G4HBI	6	4	48
JAPAN	*JA7KE	45	20	2,240
SWEDEN	*SM3DXC	24	16	1,136
WASHINGTON				
Benton	*K7RF	90	32	5,760
Chelan	*K7GAH	57	22	3,762
Clallam	*WA7YMC	162	38	15,656
Columbia	*W7GHT/M	21	17	1,071
Cowlitz	*KJ7N	511	53	70,331
Douglas	*W7GHT/M	40	21	2,520
Ferry	*W7GHT/M	9	5	135
Franklin	*W7GHT/M	13	9	351
Garfield	*W7GHT/M	13	10	390
Grant	*W7WMO	418	53	54,696
Island	*W7GHT/M	46	21	2,898
King	*KB7G	1,590	103	346,595
Kitsap	*W7IIT	49	25	3,650
Kittitas	*WA7STA	202	37	14,985
Klickitat	#*VE7ZZ/W7	1,043	109	252,771
Lewis	*WA7YFJ	8	5	80
Lincoln	*W7GHT/M	42	21	2,646
Mason	*W7DFO	122	37	10,323
Okanogan	*KD7H	233	43	30,057
Pend Oreille	*W7GHT/M	25	15	1,125
Pierce	*W7BUN	900	73	131,473
Skagit	*W7GHT/M	31	20	1,860
Skamania	#*VE7ZZ/W7	1,043	109	252,771
Snohomish	*KB7NU	527	51	54,060
Spokane	*KB7UL	637	60	76,440
Stevens	*W7GHT/M	35	18	1,890
Thurston	*WA7RDJ	86	32	6,144
Walla Walla	*W7GHT/M	31	17	1,581
Whatcom	*WB7CLU	1,484	103	305,704
Yakima	*N7AEN	264	67	37,252

*Winner of QSO Party Certificate Award
#Operated from Skamania/Klickitat county line
Numbers after call letters are: QSOs, multiplier, and total score.

Use all bands, 80 through 10 meters. In accordance with IARU recommendations, contestants are requested to operate within the lower 30 kHz of each band except when contacting Novice stations.

SCORING:

Each completed contact counts 5 points per QSO. In addition, a bonus of 20 points may be claimed for the first, second, and third contacts with each Commonwealth call area. All British Isles prefixes (G, GB, GD, GI, GJ, GM, GU, and GW) count as one call area.

AWARDS:

To the winner, the BERU Senior Rose Bowl; to the runner-up, the BERU Junior Rose Bowl; and to the leading UK station, the Colonel Thomas Rose Bowl. Certificates of merit will be awarded to the first through third placings in home and overseas multi-band or single-band entries, as well as to the leading station in each overseas call area.

ENTRIES:

Separate logs are required for each band. Each band log should be separately totalled and should include, at the end, a check list of call areas worked on the band. Logs must include GMT time, callsign of station worked, exchanges, and points claimed. Separate band totals should be added together and total claimed score entered on the cover sheet. It is important that logs are carefully checked for duplicate contacts. Unmarked duplicate contacts for which points have been claimed will be heavily penalized and logs containing in excess of five will be disqualified.

Entries may be single- or multi-band. Single-band entries should show contacts on one band only; details of contacts made on other bands should be enclosed separately for checking purposes. Multi-band entries will not be eligible for single-band awards. Each entry will consist of the separate band logs together with a cover sheet, summary, and declaration that the rules and spirit of the contest were observed. Entries should be addressed to: D. J. Andrews G3MXJ, 18 Downsview Crescent, Uckfield, East Sussex TN22 1UB, England. All entries must be received no later than May 17th.

VIRGINIA STATE QSO PARTY

Starts: 1800Z, March 13
Ends: 0200Z, March 15

Sponsored by the Sterling Park Amateur Radio Club. This year there are three categories of participation: 1) fixed or portable single transmitter, 2) fixed or portable multi-transmitter, and 3) mobile.

EXCHANGE:

QSO number and QTH (county for VA stations; state, province, or country for others).

FREQUENCIES:

Phone—3930, 7230, 21375, 28575; CW—60 kHz from low end, plus Novice bands.

SCORING:

Count one point per QSO. A station may be worked once on each band/mode. In addition, Virginia mobiles may also work the same station from each county visited. Virginia stations multiply QSO points times total of states, provinces, countries, and VA counties worked to get final score. All others multiply QSO points times numbers of VA counties worked to get final score. Virginia counties are determined by the USA-CA counties list.

AWARDS:

A plaque will be awarded to the highest Virginia score. Certificates go to the highest score in each state, province, country, and VA county.

ENTRIES

Mail logs and summary sheets no later than April 15, 1982, to A. Ray Massie K3RZR, Rt. 1 Box 115E, Dunnsville VA 22454. For a copy of the results, please include an SASE.

YL ISSB QSO PARTY—CW

Starts: 0001 GMT, March 20
Ends: 2359 GMT, March 21

Two six-hour rest periods are required. Operating categories include: single operator, DX/WK teams, and YL/OM teams. All bands will be used and the same station may be contacted on different bands for contact points but not as country multipliers. Two meters may be used, but contacts must be direct and not through repeaters.

EXCHANGE:

Name, RST, SSBer number, country, state, and partner's call. If no partner, leave blank. If non-member, send "no number."

SCORING:

Score eight points for each member contacted on any continent. Non-member contacts count *one* point. Only member station contacts count for multipliers. Multipliers are each state, country, and province, as well as each team contacted (only once for each team). When DX/WK partners contact each other, it counts as a double multiplier. Final score is sum of QSO points times the total multiplier.

ENTRIES:

Logs must show date/time (GMT), RST, SSBer number, partner's call, mode of operation, band, and period of rest time. Summary sheets show number of states, Canadian provinces, countries, YL/OM teams, DX/WK teams, and partner contacts. Send logs, summary sheets, and completed YL ISSB QSO Party applications to Minnie Connolly

WISCONSIN ASSOCIATION OF REPEATERS
NEWSLETTER

NEWSLETTER OF THE MONTH

Some clubs have broad membership with diverse interests, while others focus much more closely on a single aspect of amateur radio. Similarly, a newsletter should contain information relating to the club's specialty. A general-interest club shouldn't fill its newsletter with DX info, while a DX-club newsletter would lose readership rapidly if it concentrated on 75-meter rag chewing.

This month's winner, the Wisconsin Association of Repeaters newsletter, sticks to its specialty and covers it well. WAR is the frequency coordinating body for repeaters in Wisconsin and, frequency coordination being the touchy matter it is, keeping the members (who are primarily repeater owners) informed is very important. The December issue is four letter-size pages long and includes an editorial regarding newsletter policies and an explanation of the new size of the newsletter (it used to be printed in half-page size). WAR's chairman writes concerning the new regulatory mood in Washington and the frequency coordinator describes in a "bedtime story" a recent problem concerning coordination in the state and uses it to point out the repeater owner's responsibility in the coordination process. The bulletin finishes off with minutes of the last (quarterly) meeting—particularly important for a club which draws its membership from across a large state.

The newsletter is printed by offset on colored paper with attractive graphics. Perhaps its nicest feature is the inclusion of an up-to-date listing of all coordinated repeaters in the state, arranged by geographical region. One portion of the list is a map of Wisconsin showing the regional breakdowns, so it is easy to determine in which region a repeater belongs. The list is printed on both sides of a separate letter-size sheet, so the newsletter needn't be defaced to save the list.

A newsletter editor needs to keep in mind the audience he is trying to reach; if he gives his specialized audience the specialized information that they joined together to learn, they will be happy both with the newsletter and with the club.

KA0ALX, Star Rt. #1, Crocker MO 65452. Anyone needing blank forms or further information should send an SASE to the same address.

BARTG SPRING RTTY CONTEST

Starts: 0200 GMT, March 20
Ends: 0200 GMT, March 22

The total contest period is 48 hours, but not more than 30 hours of operation is permitted. Time spent as listening counts as operating time. The 18 hours of non-operating time can be taken at any time during the contest, but off periods may not be less than 3 hours at a time. Times on the air must be summarized on the summary sheet.

There are separate categories for single-operator, multi-operator, and shortwave listener stations. Use all amateur bands from 80 through 10 meters. Stations may not be contacted more than once any one band.

EXCHANGE:

The message exchange consists of:

1) Time in GMT; this must consist of a full four-figure group and the use of the expression "same" or "same as yours" will not be acceptable.

2) RST and message number; the message must consist of a three-figure group starting with 001 for the first contact made.

SCORING:

All 2-way RTTY contacts with other stations within one's own country earn two points; contacts outside your country earn ten points. All stations can claim a bonus of 200 points for each country worked, including their own. Note that any one country may be counted again if worked on a different band, but the continents are counted once only. The ARRL country list is used and, in addition, each W/K, VE/VO, and VK call area will be counted as a separate country. Final score is (sum of QSO points times the total number of countries worked) added to (the number of countries times 200 bonus points each times the number of continents). Note: Proof of contact will be required in cases where the station worked does not appear in any other contest log received or the station worked does not submit a check log.

AWARDS:

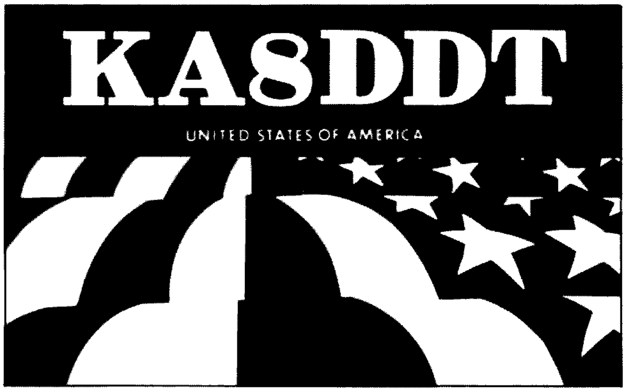
Certificates will be awarded to the leading stations in each of the three classes, the top station in each continent, and to the top station in each W/K, VE/VO, and VK area.

If a contestant manages to contact 25 or more different countries on 2-way RTTY during the contest, a claim may be made for the Quarter Century Award (QCA) issued by BARTG and for which a fee of $3.00 (USA) or 15 IRCs is required. Make your claim at the same time you send your log. Holders of existing QCA awards should indicate and list any new countries to be added to their existing records. Make your claims at the same time that you send in your log. However, due to the high volume of work, it will not be possible to prepare and dispatch any new awards or update any existing awards until the final results of the contest have been evaluated and published.

Additionally, if any contestant manages to make contacts on 2-way RTTY with each of the six continents and the BARTG Contest Manager has received either a contest or check log from each of the six stations concerned, a claim may be made for the WAC Award issued by the American *RTTY Journal*. The necessary information will be sent to the *Journal*, which will issue the WAC Award free of charge.

ENTRIES:

Use a separate sheet for each band and indicate all times on the air. Logs should contain: date/time in GMT, callsign of station worked, RST and message number sent, time RST and number received, and points claimed. Logs received from shortwave listeners *must* contain the callsign of the station heard and the report sent by that station to the station he is working. Incomplete loggings are not eligible for scoring. The summary sheet should show the full scoring, the time *on* the air, and, in the case of multi-operator stations, the names and callsigns of all operators involved with the operation of the station. All logs must be received by May 31st in order to qualify. Summary and log sheets are available from the Contest Manager at the address shown below. The judges' decision will be final and no correspondence can be entered into with respect to incorrect or late entries. All logs submitted will remain the property of the British Amateur Radio Teleprinter Group. Send entries to: Ted Double G8CDW, 89 Linden Gardens, Enfield, Middlesex EN1 4DX, England.



QSL OF THE MONTH: KA8DDT

Does the design on David Ashenfelter KA8DDT's card look familiar? It's based on graphics used by ABC News during the 1980 presidential election.

If you would like to enter our contest, put your QSL card *in an envelope* and mail it, along with your choice of a book from *73*'s Radio Bookshop, to *73 Magazine*, Pine Street, Peterborough NH 03458, Attention: QSL of the Month. Entries which do not use an envelope (the Postal Service does *occasionally* damage cards) and do not specify a book will not be considered.

SPRING VHF QSO PARTY

Starts: 1600 local time, March 27
Ends: 2400 local time, March 28

Sponsored by the Ramapo Mountain ARC. The contest rules are considerably different from the last two contests.

Classes of entry include single- and multi-transmitter. A station of the single-transmitter class may operate using several different transmitters but may not emit more than one signal at any given time. A station of the multi-transmitter class may operate simultaneously with a single emission on several different bands. The number of operators, loggers, etc., does not affect the class of the station entry.

A section is defined as a geographical area one degree in longitude by one degree in latitude, identified by a 4- or 5-digit number indicating the next lowest degree of longitude and latitude. Example: RMARC club station WA2SNA, located in Oakland NJ at 74° 15' west and 41° 3' north, would use a section designator of 7441.

Each QSO has a point of value based on the distance between stations as determined by the larger of the differences between the section designators' latitude or longitude plus 1, with a maximum of 10 QSO points. Example: WA2SNA in 7441 works W3XX in 7638. The difference between 74 and 76 is 2. The difference between 41 and 38 is 3. Three is the larger difference, so adding 1 to it would result in 4 QSO points.

The section multiplier is the total number of different sections worked per band. The following band multipliers are used to determine the final score per band: 50 MHz = ×1, 144 MHz = ×2, 220 MHz = ×4, 432 MHz = ×8, 1296 MHz = ×16, and 2304+ MHz = ×32. The score per band is equal to the total of QSO point values per band times the section multiplier times the band multiplier. The total score is the total of individual band scores. Each two-way QSO must include an exchange of station callsign, section designator, and class of entry (single- or multi-transmitter).

Prepare a separate log sheet for each band. Heading information must include your station callsign, section designator, and class of entry. Each individual QSO entry must include date/time (GMT), callsign, section designator, and entry class of the station worked, and the QSO point value. Per band summary information must include the total of QSO point values

and the total of different sections worked.

Prepare one entry sheet, indicating for each band: band, QSO point total, number of sections, band multiplier, and band score. Also include the total of all band scores. This sheet must also include your station callsign, your section designator, ARRL section and division, and mailing address, and *must be signed* by the licensee or trustee of the call used.

An SASE to the RMARC will obtain log and entry forms. All who submit the required data will receive a copy of their newsletter with results. Award certificates will be issued to the highest scoring stations on each band as well as on a total basis in each ARRL section, division, and overall. Mail forms no later than May 1st to: Ramapo Mountain ARC, PO Box 364, Oakland NJ 07436.

CW & RTTY WORLD CHAMPIONSHIPS

CW Event: 0000 to 2400 GMT, April 3

Phone Event: 0000 to 2400 GMT, April 4

Sponsored jointly by *73 Magazine* and the *RTTY Journal*. Use all bands, 10 through 80 meters, on the specified mode. Cross-mode contacts do not count. The same station may be worked *once* per mode.

Operator classes are: a) single operator, single transmitter, non-computerized; b) single operator, single transmitter, computerized; c) multi-operator, single transmitter, non-computerized; and d) multi-operator, single transmitter, computerized. Single operator stations may work 18 hours maximum per mode, while multi-operator stations may operate the entire 24-hour period. Off times are no less than 30 minutes each and must be noted in logs. To be eligible for the computerized class, your station must be interfaced with a microprocessor-controlled RTTY and/or CW operating system such as the TRS-80, Heath/Zenith, Apple, PET, OSI, Hal, etc. Utilizing a memory keyer for CW does not constitute a computerized station.

Entry categories are: a) CW only, b) RTTY only, and c) CW and RTTY both.

EXCHANGE:

Stations within the 48 contiguous United States and Canada must send RST and state, province, or territory. All others will send RST and a consecutive contact number. If your station is computerized, add the letter "C" to the end of your exchange.

SCORING:

Count 1 QSO point for each valid contact. An additional *bonus* point is earned if the station worked is computerized and sent a "C" at the end of his exchange. Count 1 multiplier point for each of the 48 contiguous United States and each Canadian province/territory and DX country (outside the contiguous US and Canada). The total claimed score is the total QSO points times the total multiplier points.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts and Canadian provinces and territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 5 hours and 50 QSOs must be worked on a mode to be eligible for awards.

ENTRIES:

Entries must include a *separate* log for each event entered, a dupe sheet, a summary sheet, a multiplier check list, and a list of equipment used for each mode of operation. Contestants are asked to send an SASE to the contest address for official forms!

Omission of the required entry forms, operating in excess of legal power, manipulating scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

Entries must be postmarked *no later than* May 10th and sent to: CW and RTTY Championships, c/o The *RTTY Journal*, PO Box RY, Cardiff CA 92007.

HAMVENTION® '82 DAYTON

★ Technical Forums
★ ARRL and FCC Forums
★ GIANT 3-Day Flea Market
★ New Products and Exhibits
★ Grand Banquet
★ Women's Activities
★ New! Home-Brew Equipment Forum
★ Special Group Meetings
★ YL Forum
★ New! Personal Computers Forum
★ Amateur of Year Award
★ Special Achievement Awards

April 23, 24, 25, 1982

Hara Arena and Exhibition Center — Dayton, Ohio

Meet your amateur radio friends from all over the world at the internationally famous Dayton HAMVENTION. Seating will be limited for Grand Banquet and Entertainment on Saturday evening so please make reservations early. Banquet speaker is Roy Neal, K6DUE, NBC News.

If you have registered within the last 3 years you will receive a brochure in late February. If not write Box 44, Dayton, OH 45401.

Nominations are requested for Radio Amateur of the Year and Special Achievement Awards. Nomination forms are available from Awards Chairman, Box 44, Dayton, OH 45401.

For special motel rates and reservations write to Hamvention Housing, 1406 Third National Bldg., Dayton, OH 45402. **NO RESERVATIONS WILL BE ACCEPTED BY TELEPHONE.**

All other inquiries write Box 44, Dayton, OH 45401 or phone (513) 849-1720.

Rates for ALL 3 Days: Admission: $7 in advance, $8 at door.
Banquet: $14 in advance, $16 at door.
Flea Market Space: $15 in advance.

Make checks payable to Dayton HAMVENTION, Box 333, Dayton, OH 45405.
Bring your family and enjoy a great weekend in Dayton.
Sponsored by the Dayton Amateur Radio Association, Inc.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

TEN-METER FM AWARDS

- Sponsored by the North Whidbey Island Repeater Association (NWIRA).
- All contacts, to be valid, must have been made on/after January 1, 1981.
- Crossmode contacts do not count. Contacts must be 2-way ten-meter FM.
- Special endorsements can be made for all-mobile, all-simplex, and single-frequency accomplishments and contacts made within a single day, week, month, or year.
- Note: Members of the NWIRA monitor 29.600 MHz, as well as the area repeater on 29.640 MHz (an 1800-Hz tone or whistle is required to access).
- *Do not* send QSL cards! Forward your list of contacts showing the date, time, and frequency of each QSO and provide a brief station description, along with the fee of $4.00 for each award, to Ten-Meter FM Awards Program, 2665 North Busby Road, Oak Harbor WA 98277.

Worked All Districts Award

To qualify, applicants must work one ten-meter FM station in each of the ten US call districts.

Worked All States Award

Applicants must work a *minimum* of fifty US states on ten-meter FM.

Centurion Award

This award requires the applicant to work a *minimum* of 100 stations on ten-meter FM.

DX Decade Award

Applicants must work a *minimum* of ten DX stations outside the fifty US states and Canada on ten-meter FM.

North American Award

To qualify, applicants must work all ten US call districts, a *minimum* of six Canadian provinces and/or territories, and at least four DX countries within the North American continent (other than the US and Canada) on ten-meter FM.

OPERATING ACHIEVEMENT AWARDS FROM *A5 MAGAZINE*

Fast-Scan ATV Award

"Getting the amateur television station operating is an award in itself!" This award certificate recognizes the "first" amateur television two-way contact. Endorsements for DX mileage and color ATV are available. Contacts via ATV repeaters are allowed. Award inscriptions are made around the border of the A5 block. Black/white, 8" × 10".

Master Scanner A5 SSTV Award

This award certificate recognizes the serious SSTVer. Entry level is 100 two-way SSTV contacts. Endorsements for 500, 1000, 1500, 2000, etc., are available. Special endorsement for color SSTV available with verified print copy. A must for every SSTVer! Gold, 8" × 10".

Specialized Communications Achievement Award

This award recognizes accomplishments in ATV, MSTV, NBTV, SSTV, fax, RTTY, EME, microwaves, and satellites. Entry levels are contacts over 100 miles on ATV. Special-event ATV projects, 25 DX country contacts on SSTV, reception of HF MSTV or fax signals via amateurs, microwave DX, 10 DX foreign countries via EME, 10 two-way contacts on an amateur satellite, and 25 DX countries on RTTY are required, with special endorsements available for additional contacts. Certificates are numbered as received. Gold, 8" × 10", suitable for framing.

Worked All States SSTV

Work all 50 states (including Hawaii and Alaska) with exchange of callsign and signal report in video. A special WAS map is available to color in the states as you get them. This is an ongoing award not limited to the annual contest. Special endorsements available for multiband WAS.

Worked All States RTTY

Work all 50 states (including Hawaii and Alaska) with log copy verification. This is an ongoing award not limited to the annual contest. Special endorsements available for multiband WAS.

"Good Image" Award

Awarded at the Dayton Hamvention each year, the Good Image Award is presented to the individual or group of individuals who contributed to the advancement of the A5 code of communication by technical achievement or public awareness. Top-of-the-line award!

All *A5 Magazine* awards require subscription label information date codes. Enclose $1.00 for the cost of the award certificate and 50¢ postage for return mailing (envelope is provided). Allow 2-3 weeks for verification and mailing. Send all requests to Awards Manager, *A5 Magazine*, PO Box H, Lowden IA 52255-0408. Winners of awards will be published on a regular basis in *A5 Magazine*.

CENTRAL STATES VHF SOCIETY OPERATING AWARDS

At the 1981 Central States VHF Conference in Sioux Falls, South Dakota, in August, the Central States VHF Society formally announced its new operating awards program with three colorful awards for VHF/UHF/SHF bands.

Each award was designed to stimulate activity on the bands above 144 MHz. The differences in the awards as well as the variety of endorsements available provide challenging but achievable goals regardless of the station's geographic location or capabilities.

The awards are open to all amateurs—not just CSVHF Society members. To receive rules and application sheets, send a legal-size SASE (with two stamps) to Bob Taylor WB5LBT,

10715 Waverland, Baton Rouge LA 70815.

General Rules—All Awards

● The awards described below are available to all amateurs worldwide who submit details of the required contacts (on the separate award Application Detail Sheet) and have the accuracy of the application certified by a local member in good standing of the CSVHF Society. In addition to the basic awards, certain optional endorsements are available as described below and on the Application Cover Sheet.

● For all awards, direct two-way communication must be established on amateur radio bands of 144 MHz and above. Minimum contact requirements are the exchange of callsigns, signal reports (or other mutually understood information), and receipt of acknowledgement that both stations have received this information. All contacts for each award must be on the same band.

● Contacts must be made from the same location or from other location(s) licensed to the applicant, no two of which are more than 50 miles apart.

● Contacts for the VUCC and WHG awards may be made over any period of years, with no starting date, but *numbered* certificates will only be issued to those who have made all the required contacts after August 1, 1981. 1K Coverage Award contacts must be made during any two consecutive months after August 1, 1981.

● Contacts made through "repeater" devices or any other power relay method do not count toward any of the awards. In addition, no crossband contacts are permitted.

● False statements on the Application Cover Sheet or on the Detail Sheet(s) shall result in immediate disqualification for any of the awards.

● Remember, you do not have to be a member of the CSVHF Society to apply for an award. However, if you wish to join, send the $5.00 membership dues to: Ted Mathewson W4FJ, CSVHF Society Secretary, 1525 Sunset Lane, Richmond VA 23221. Please do not send dues with awards applications.

VUCC

The VUCC (VHF/UHF Century Club) award simply requires contacts with 100 different amateur stations. Optional endorsements for working additional stations in increments of 25 (e.g., 125, 150, 175, etc.) or for making all the contacts during a single calendar year (Jan. 1 through Dec. 31) are available *only* if all the contacts were made on the same mode of propagation (sporadic E skip, EME, meteor scatter, or aurora).

1KCA

The 1K Coverage Award requires contacts of sufficient number and distance such that the sum of the QSO points for all the contacts during *each* of any two consecutive calendar months is equal to or greater than 1000. The QSO points for any given contact are the band points multiplied by the distance points. The band points are determined as follows: 144 = 2, 220 = 5, 432 = 4, 1295 = 5, 2300 = 10, 3300 = 15, 5650 = 25, and 10 GHz and up = 50. The distance points are simply the number of 1° × 1° "grids" (see definition under WHG Award) you are away from the other station's 1° × 1° grid. For example, if the station is in the next grid over from yours, the distance points for the contact are 1; if it is two grids over, the distance points are 2, etc. Contacts in your own grid have a distance point value of 1. For stations which are not in a grid directly north, south, east, or west of yours (i.e., off at an angle), the distance points have to be calculated. In such cases, the distance points are equal to the square root of the sum of the latitude difference squared and the longitude distance squared, where the differences in latitude and longitude are measured in numbers of whole 1° × 1° grids. The resulting distance points are to be rounded off to the nearest tenth. Only one contact with a given station per GMT day counts toward this award, and EME contacts do not count. There are no additional endorsements available for this award.

WHG

The WHG (Worked Hundred Grids) award requires contacts with stations in 100 different 1° × 1° geographic "grids." The 1° × 1° grids are defined as the area bounded by integral values of latitude and longitude. For example, a station whose longitude is 112° 32' 15" west and latitude is 37° 25' 16" north would be in the grid 112W37N. All stations are urged to include their latitude and longitude and/or equivalent recognized QTH locator code on their station cards to assist others in determining their grid. If you have to determine the other station's grid yourself, it can be easily done by looking up the town location in any good road atlas and the locating the position on a larger map which shows the 1° lines of latitude and longitude. Two such maps are:

1. "Map 2-A," which comes in two halves (54" × 80" assembled) and is available for $3.00 postpaid from: Branch of Distribution, U.S. Geological Survey, Federal Center, Denver CO 80225. Shown are counties, county seats, capitals, and cities larger than 500,000.

2. Rand McNally's "Contemporary United States," which measures 36" × 54" and is available through bookstores for $2.95. The map does not show counties but does include major highways, a number of cities and towns, and 3° more latitude in Canada than the USGS map.

Optional endorsements are available for working additional 1° × 1° grids in increments of 25 (e.g., 125, 150, 175, etc.) or for working all the different grids in a single calendar year.

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

HOW HAMS VIEW THEMSELVES II

Here we go again. One year and two postal increases later, it's time once more for the famous Fun! poll.

For those who missed last year's event, the Fun! poll is not a scientific survey. What it represents, though, are the gut feelings of amateurs as they answer questions ranging from their personal lifestyles to how they view emerging trends in our hobby. Last year we discovered, for instance, that 12 percent of our respondents used a "cheat book" to upgrade, 54 percent felt that ham radio interfered with their personal relationships, and 61 percent would give up the hobby for a million dollars.

This time around we're keeping many of the old questions and adding some new ones. I hope that you'll take the time to fill out the response sheet and mail it to *the address at the top of this column*.

Last year, some club officers wrote in to say that they made the poll a meeting activity. Photocopy ballots were passed out and members were encouraged to voice their opinions on the various topics. I think that's a great idea. Anything that can get hams thinking and talking can't be all bad. Just be sure to mail in those ballots

ELEMENT 1—BACKGROUND

1) Sex:

A) Male
B) Female

2) Age:
A) 15 or below
B) 16-21
C) 22-39
D) 40-59
E) 60 and above

3) License class:
A) Novice
B) Technician
C) General
D) Advanced
E) Extra

4) Number of years licensed:
A) 1 year or less
B) 1-5 years
C) 6-10 years
D) 11-20 years
E) 21 years and up

5) Do you have a new (post-March '78) call?
A) Yes
B) No

6) How many hours a week do you devote to amateur radio?
A) 0-1 hour
B) 2-5 hours
C) 6-10 hours
D) 11-20 hours
E) 21 hours or more

7) Which HF band do you most use?
A) 80-75 meters
B) 40 meters
C) 20 meters
D) 15 and/or 10 meters
E) Don't operate HF

8) Which VHF-UHF band do you most use?
A) 6 meters
B) 2 meters
C) 220 MHz
D) 420 MHz and/or up
E) Don't operate VHF-UHF

9) Which mode do you most use?
A) SSB
B) CW
C) FM
D) RTTY
E) Other

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues, and other incidental expenditures.)
A) 0-$250
B) $251-$500
C) $501-$1,000
D) $1,001-$2,500
E) $2,501 and up

ELEMENT 2—SOCIAL CHARACTISTICS

11) Has amateur radio influenced your career choice?
A) Greatly
B) Somewhat
C) Not at all

12) Do you answer QSLs with no return postage?
A) Yes
B) No

13) Politically, how would you define yourself?
A) Conservative
B) Middle-of-road
C) Liberal

14) Do you think amateur radio will exist 20 years from now?
A) Yes
B) No

15) Have you ever had a fight with a family member over amateur radio?
A) Yes
B) No

16) Do you have any relatives who are hams?
A) Yes
B) No

17) Are most of your friends (more than half) hams?
A) Yes
B) No

18) Did you ever use a "cheat book" (not counting the ARRL License Manual) to upgrade your license?
A) Yes
B) No

19) If someone offered you five million dollars, tax free, on the condition you give up amateur radio forever, would you?
A) Yes
B) No

20) Do you belong to a local ham radio club?
A) Yes
B) No

21) Have you ever attended a ham flea market?
A) Yes
B) No

22) Have you ever attended the Dayton Hamvention?
A) Yes
B) No

23) Would you pay five dollars to join the ARRL if they offered no magazine, QSL services, awards, or technical and instructional help?
A) Yes
B) No

24) Would you like to see another national organization compete with the ARRL?
A) Yes
B) No

ELEMENT 3—OPERATING HABITS

25) Would you favor a licensing system that had only two classes: Novice and General or Communicator and General?
A) Yes
B) No

26) Would you like to see the FCC turn over amateur testing responsibility to clubs?
A) Yes
B) No

27) Do you think religious and politically-oriented nets have a place in ham radio?
A) Yes
B) No

28) Should contests be outlawed?
A) Yes
B) No

29) Do you think the FCC should assign exclusive frequencies and times to nets?
A) Yes
B) No

30) Do you think the FCC should assign exclusive frequencies to repeaters?
A) Yes
B) No

31) Should there be a no-code, VHF and above, "digital-class" license? This license would require a heavy theory test and carry no phone or CW privileges (except perhaps for ID purposes).
A) Yes
B) No

32) Should there be a no-code, 220 MHz, "communicator-class" license? This license would require a moderately difficult theory test and carry only F3 privileges at a maximum of 50 Watts.
A) Yes
B) No

33) Do you own a microcomputer?
A) Yes
B) No

34) What sort of CW sending device do you most often use?
A) Straight key
B) Keyer
C) Bug
D) Keyboard
E) Never operate CW

35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes
B) No

36) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes
B) No

37) Do you think the FCC affects amateur radio in a positive manner?
A) Yes
B) No

38) Do you ever speak to foreign, non-English-speaking hams in their own language?
A) Always
B) Sometimes
C) I attempt it
D) Rarely
E) Never

39) Do you feel yourself competent to replace the finals in a tube-type rig?
A) Yes
B) No

40) Do you feel yourself competent to replace the finals in a transistor-type rig?
A) Yes
B) No

41) Have you ever built an electronic project from a kit?
A) Yes
B) No

42) Have you ever "home-brewed" an electronic project from a book or magazine?
A) Yes
B) No

43) Have you ever designed your own electronic project?
A) Yes
B) No

44) What do you think of contesting?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

45) What do you think of DXing?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

46) What do you think of repeaters?
A) Great
B) Good
C) Okay
D) Don't like them
E) Despise them

47) What do you think of traffic handling?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

48) Do you plan to use Phase III OSCAR within a year of its launch?
A) Yes
B) No

49) Do you plan to use the new 10.1 MHz band within one year of its opening?
A) Yes
B) No

50) Do you believe amateurs should have the right to build, use, and sell equipment intended for the reception of subscription television?
A) Yes
B) No

RESPONSE FORM

Instructions: Read each question and mark your response by circling the appropriate letter next to the number of the question.

Element 1:

1)	A	B			
2)	A	B	C	D	E
3)	A	B	C	D	E
4)	A	B	C	D	E
5)	A	B			
6)	A	B	C	D	E
7)	A	B	C	D	E
8)	A	B	C	D	E
9)	A	B	C	D	E
10)	A	B	C	D	E

Element 2:

11)	A	B	C
12)	A	B	
13)	A	B	C
14)	A	B	
15)	A	B	
16)	A	B	
17)	A	B	
18)	A	B	
19)	A	B	
20)	A	B	
21)	A	B	
22)	A	B	
23)	A	B	
24)	A	B	

Element 3:

25)	A	B			
26)	A	B			
27)	A	B			
28)	A	B			
29)	A	B			
30)	A	B			
31)	A	B			
32)	A	B			
33)	A	B			
34)	A	B	C	D	E
35)	A	B			
36)	A	B			
37)	A	B			
38)	A	B	C	D	E
39)	A	B			
40)	A	B			
41)	A	B			
42)	A	B			
43)	A	B			
44)	A	B	C	D	E
45)	A	B	C	D	E
46)	A	B	C	D	E
47)	A	B	C	D	E
48)	A	B			
49)	A	B			
50)	A	B			

Comments:______________________________

Send to: John Edwards KI2U, 78-56 86th Street, Glendale NY 11385.

REVIEW

THE YAESU FT-680R TRANSCEIVER

The Yaesu FT-680R is a compact, six-meter, multi-mode transceiver designed for both mobile and fixed station use. It is part of a rather complete line of nearly identical VHF/UHF transceivers which includes the FT-480R two-meter and the FT-780R 430-MHz multi-mode rigs.

The FT-680R is fully synthesized, with a four-bit NMOS microprocessor-controlled operating frequency, scanning, priority channel selection, and the various memory functions. Frequency coverage is from 50 to 53.99999 MHz, in steps of 10 Hz, 100 Hz, and 1 kHz in SSB (CW and AM modes) and 1-kHz, 20-kHz, and 100-kHz steps in the FM mode. These steps correspond to one click on the main tuning knob, or one press of the up or down buttons on the microphone.

Of the sixteen controls on the front panel, eleven are associated with frequency selection. The other five are volume and squelch controls, high/low power switch, and a noise-blanker on/off switch. The microphone jack is an eight-pin affair identical to that found on many Icom rigs and provides for microphone-mounted up/down scanning switches, a "Call" button for tone-burst operation, and a microphone lock switch, in addition to the obligatory PTT, signal, and ground lines.

Underneath the front panel on the right-hand side are three switches: SAT, which allows the operating frequency to be changed while transmitting, a repeater offset selector, and a busy/clear scanning selector. A miniature connector is located near the back of the bottom panel, allowing tone burst on six meters. The unit's speaker is also on the bottom panel.

The rear panel is mostly heat sink, but squeezed into the corners are jacks for antenna, power, and CW key. The entire unit measures approximately 2½" high, 7¼" wide, and 9½" deep. A hefty mobile bracket is included, as is a wire bail for home use. The bail is necessary because the speaker housing prohibits the rig from sitting flat on a table without it.

Other Features

Upon first unpacking the FT-680R, I decided that the front panel was the most confusing I had ever encountered. This is no small distinction, considering the needlessly complex panels on some of the competition! However, my opinion was modified considerably after reading the instruction manual. In retrospect, the 680 offers a thoughtful layout. What need work are some of the labels over the switches. For example, use of the switch marked DIL is not exactly obvious. A glance at the manual explains everything. The switch "... transfers frequency control from the memory channels to the main tuning knob." That makes perfect sense, but please don't ask me what it has to do with DIL! Once you understand some of the confusing labels, the front panel is a lot friendlier.

There are four memories available as well as a priority channel. These function in the generally accepted manner. An interesting and extremely useful twist is the clever programming of the up/down switches on the microphone. At first, they appear to operate just like the mike switches on countless other rigs, but if you hold down one of the switches for more than half a second, the automatic scanner is activated. Even if you release the switch, the unit will continue to scan up or down the band. To stop, simply press either the up or down buttons or the PTT switch. Surprisingly, pushing the PTT switch during scanning will not result in a transmission. The next time you press it though, it will behave normally and you'll be on the air. Nice touch!

The controls on the underside of the transceiver are inconvenient and their labels impossible to read without turning the rig over. Yaesu's engineers correctly assumed that most users would rarely need access to these controls, but they failed to consider how easy it is for an operator unknowingly to change the position of the switches while moving the rig. Hopefully, Yaesu will not mount switches here on future rigs.

Particularly useful to the six-meter DXer is the inclusion of semi-break-in operation on the CW mode. Also included is an 800-Hz sidetone. Missing is an amplifier-keying jack. With 4CX250 amplifiers so easy to home-brew for this band, such a jack is sorely missed. Fortunately, adding one should prove to be easy for anyone on familiar terms with a soldering iron.

The Yaesu FT-680R six-meter transceiver. (Photo by KA1LR)

On the Air

The FT-680R spent several weeks accumulating dust on the shelf after its arrival because I couldn't find the time to install a proper six-meter yagi. One Friday evening as my wife and I settled in to view our favorite program on Channel 2, we found it had been pre-empted. The Boston station we had planned to watch faded in and out of the hash, and then for a few minutes a Florida news broadcast captured the set completely! Without so much as a word, Alyson went to the ham shack, got the FT-680R, and dropped it at my feet. We found a spare 12-volt supply and then hooked up the rig to a Radio Shack TV antenna on the roof. The swr was about 3:1, but the rig put out almost full power and didn't make any funny noises, so I started tuning up the band. Among other things, we heard a Georgia station calling CQ, and I gave him a quick call. Wonder of wonders, he came back with a 59 report! Over the weekend, I worked 21 states in the south and midwest, using 10 Watts PEP and a TV antenna fed with 75-Ohm coax. Bob Cooper in the Turks and Caicos came in 59 + 20 Saturday morning, but I apparently couldn't be heard over the pileup of kilowatts and stacked arrays. I did manage to make several contacts elsewhere using the low-power position (one Watt PEP), but signal strength reports at this power level were not uplifting.

When the band finally went dead and I reconnected the TV, it occurred to me that I had forgotten about the lossy 300-Ohm to 75-Ohm transformer installed at the antenna. Close examination revealed it to be undamaged, but I've always wondered how much power I lost in the darn thing!

All things considered, the 680's performance is outstanding. Receiver sensitivity is more than adequate for all but the most demanding weak-signal work. After a couple of hours with most multi-mode rigs, one usually begins thumbing the catalogs in search of a suitable preamp, but no one who used the 680 ever felt the urge. Receiver audio quality was very good—better than that found on other Yaesu transceivers. Transmit audio reports were excellent, and I'm just as glad the 680 doesn't include a speech processor! The Monadnock region of New Hampshire is not exactly bursting with FM six-meter activity, so about all I can say about the FM section is that it works.

The instruction manual is very complete. Several other well-known manufacturers would do well to offer the sincerest form of flattery—imitation. As well as the usual specifications and operating instructions, the FT-680R owner is furnished with alignment and service instructions, a parts list, a theory of

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operation section, and three poster-sized schematics. An amateur radio operator deserves nothing less.

A rather complete line of optional accessories is offered for the 680. For those of us too lazy to build our own, there is the FP-80 dc power supply. The AD-1 antenna coupler permits a single mobile antenna (the RSL-50) to be used with both six- and two-meter rigs at the same time. One less hole in the old crate. Home-station operators will appreciate the choice of stand microphones, including one with scanning push-buttons in the base. Finally, for owners of the 680 and one of its twins, there is the SC-1 station console which makes the rigs into a single compact package and includes a power supply, digital clock, 16-button DTMF pad, and some convenient switching.

Conclusion

Six meters remains one of our interesting amateur bands. Propagation is often unpredictable and wild, rewarding the alert operator with dizzying tours of the country. On occasion, it is rather tame, behaving like a mischievous 10 meters, offering long, solid rag-chews before sweeping your friend off the S-meter. As solar activity provides fewer opportunities to sample the thrills of six-meter DX, the FM position on the mode switch will offer a bastion of tranquility and camaraderie, free from the crowding and circus-like atmosphere that prevails on other, more populous FM bands. Six meters offers some of the very best of the HF and VHF worlds, and the FT-680R provides an excellent means to sample the action. In features, price, and performance, it stands with the best. Yaesu has a winner!

For information, contact *Yaesu Electronics Corp., 6851 Walthall Way, Paramount CA 90723,* Reader Service number 483.

Paul Grupp KA1LR/4
Casselberry FL

THE CURTIS K5 KEYER

The Curtis keyer IC has been used in countless keyer models offered by a wide range of manufacturers, and with good reason. The chip offers almost every feature a radio operator could require in a non-memory keyer, and very few additional components are needed to produce a complete unit. But while everyone was building keyers around the chip, almost all neglected its most obvious use. Since the component count is so small, why not produce a tiny keyer that could go anywhere, anytime? Well, that's exactly what Curtis did!

The K5 keyer measures only 1-1/2" square by 3-1/16" deep. A tiny glass-epoxy circuit board is securely screwed to a U-shaped piece of .062" heavy aluminum. This assembly slides into a rectangular case, also made of .062" aluminum, and is held in place by friction fit.

On the rear panel are a phono jack for transmitter keying, a submini phone jack for power, and a submini phone jack for sidetone output. Four eight-inch-long lugged wires exit through a plastic grommet. These are for connection to keyer paddle and straight key.

Correctly, the Curtis engineers judged that the only control that most users would need immediate access to is the combination speed control and on/off switch. This is mounted on the otherwise bare front panel. By mounting seldom-used controls inside the box, enough space was saved to allow room for a standard 9-volt transistor battery.

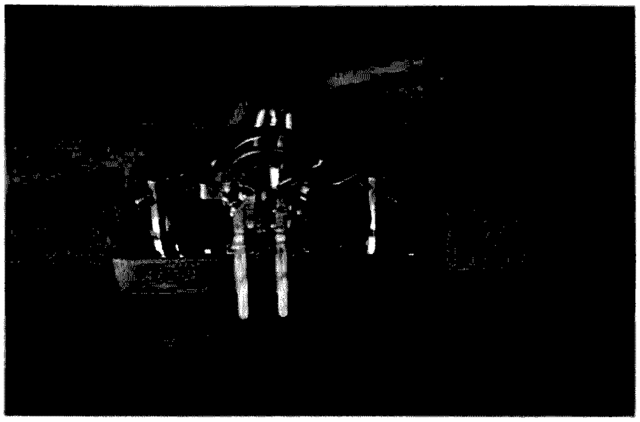
The internal controls are all miniature trimpots. Sidetone frequency is set to 1000 Hz and volume to a nominal level. The sidetone output is really only designed to drive headphones (there is no internal speaker), but the instruction manual points out that a 500-Ohm to 8-Ohm miniature transformer will bring up the volume to a usable speaker level.

There is also an internal control for weighting, factory-set to 3:1. Curtis discourages the use of nonstandard weighting, but provides complete instructions on the use of the control for hams with special requirements as well as for those diehards who insist on making a perfectly good keyer perform something like a grossly maladjusted Vibroplex bug. If you can't resist playing with the weighting, rest assured that it is easily reset to 3:1 by turning the control fully counterclockwise.

A particularly useful control is the maximum-speed trimmer. The keyer is factory-set for a top speed of 50 wpm, but this can be raised or lowered appreciably by adjusting the maximum-speed trimmer to taste. For example, I never send faster than 25 wpm. By setting the trimmer for this slower top speed, I enjoy a much wider range of adjustment with the front-panel speed control.

In the Real World

Curtis's years of experience producing keyers are evident in the design of the K5. It's no use



The Curtis K5 keyer with Bencher paddles. (Photo by KA1LR)

having a portable keyer if it places an unseemly demand on available power. The K5 draws less than 50-uA quiescent current and about 20 mA while keying with an average sidetone level. Turning the sidetone off completely reduces drain somewhat.

The K5 is designed to operate at 9 V dc, but can be operated at up to 20 V dc as long as the battery is removed before the higher voltage is applied. For lower voltages, the relay's current limiting resistor can be shorted out, which will permit operation with as low as 3 V dc input. The voltage range recommended for most reliable operation is 5 to 15 V dc.

Because of the K5's sealed-contact tungsten relay, keying incompatibility problems are a thing of the past. The touchiest solid-state keying circuit (like the one in my Icom IC-701) is keyed without complaint. No more changing polarity when switching rigs, either! The maximum contact rating of 500 V, 1 A at 15 VA should handle your swishing clobber from the fifties with ease. And if you are worried about getting along with a noisy relay, relax—this one makes less noise than the contacts on my Bencher paddle!

Importantly, the circuitry is well-protected against the harsh electrical environment amateur radio equipment often faces. A diode in the power-input line protects the keyer from reverse polarity. Both sides of the output relay are protected against inductive-kickback spikes. Anything and everything that could suffer from rf pickup is bypassed and/or equipped with a ferrite bead. The paddle inputs include debouncing circuitry, and two pairs of germanium diodes protect them from accidental application of voltage.

One potentially confusing feature of the K5 is its availability in two different models. The K5 offers iambic keying that handles like earlier Curtis keyers. The K5B offers iambic keying with characteristics similar to the Accukeyer, AEA, Heath, Nye, and Ten-Tec units. Make sure you order the model that provides the characteristics that you are familiar with. If this is to be your first keyer, the K5B would be your best choice since you won't have to relearn anything when you use a keyer from a different manufacturer. If you ever wish to try an alternate method of "paddling," you can simply unplug the chip and replace it with the other version.

It is hard to imagine a better keyer for the ham who doesn't require a unit with memory capabilities. It should be especially popular with hams who use portable multi-mode VHF and UHF gear. No more sending CW with the mike button to make a few contacts during a meteor shower!

Whenever you use it though, you'll find that the K5 produces code that is indistinguishable from its more expensive and bulkier competitors. And as a ham who frequently tests new transceivers, I find the relay-driven transmitter keying particularly useful. I own several excellent keyers from a variety of manufacturers, but because the K5 never needs rewiring to make it compatible with a new transceiver, it's always the first keyer connected to a new addition to the shack.

For more information, contact: *Curtis Electro Devices, Box 4090 Mountain View CA 94040.* Reader Service number 484.

Paul Grupp KA1LR/4
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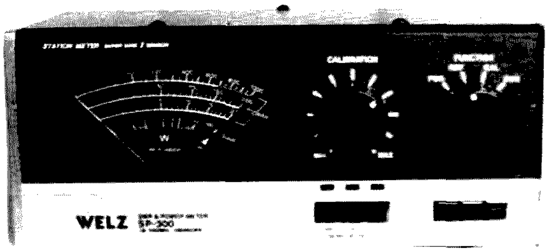

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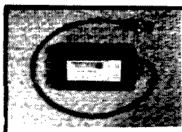

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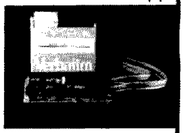

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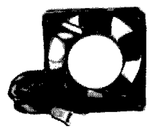

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apr. 82

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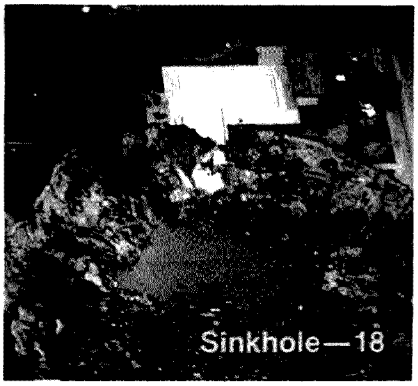
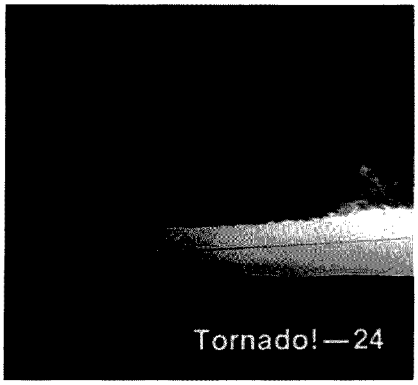
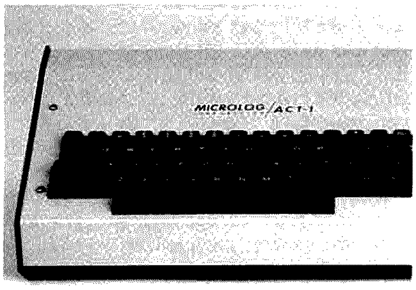


Sinkhole—18



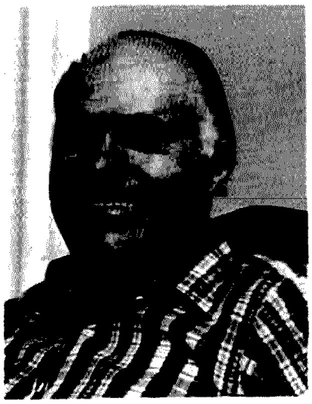
Tornado!—24



ACT-1—120

Cover: This month's cover by Alex Stevens depicts the astonishing 350-mater (1148') rotating tower of French amateur Pierre Avril FØOL. Erected during the spring and summer of 1981, the massive structure tapers from 5.25 meters (17' 2-5/8") at the base to 1.25 maters (4' 1-1/4") at the top. It was designed with the assistance of Swedish engineer Vassa Loppet SL1M and is constructed entirely of scrap metal salvaged from the Saturn V project and Soviet world's fair exhibits. Pierre, who operates mostly CW, is an avid county hunter and holds numerous operating awards. He credits his now potent signal to the use of 6-cm (2-1/4") nitrogen-filled hardline, his trusty TH6DXX, and the selection of a hilltop OTH. This triumph of the amateur spirit is located at Pierre's home in the quiet village of St.-Fou-des-Ondes-Courtes, Dept. de la Haute Tour, southern France. Look for the construction details on this monster in an upcoming issue of 73.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green



WE'VE BEEN BASHED

Word has leaked out that Dick Bash, the chap who publishes the books with the answers for the FCC tests, is about to bring suit against *QST* because they won't let him advertise his books. Well, I don't know what their excuse is for that. I suspect that they just don't want to help sell a book in direct competition with their *Q&A Manual,* which does about the same thing, only not quite as well.

There was a fuss a little while back when the FCC was reported to have lowered the boom on *Ham Radio* magazine, essentially telling 'em that if they continued to carry ads for the Bash books, the FCC would cut off information for their *HR Reports* (now defunct). The FCC has made no bones about being very upset over what they see as a total defeat of their license exams.

My own view is that Bash's books are one of the most destructive forces in amateur radio. They have removed the last vestige of need for a newcomer to bother to learn even a shred of knowledge about the technical end of things, opening the gates to anyone who can learn the code at five words per minute. We've seen that kids of four can do that, so it certainly is no accomplishment worthy of great pride. And so, while on the one side I see most hams demanding that *only* the code be used to keep out the undesirables, on the other I hear them bitching about the growing mayhem on the bands as new turkeys get on the air.

The Bash books, as far as I'm concerned, are a poison which is rapidly sapping the strength of what was once a proud hobby. If Carrie Nation were around today, she would rip 'em up and let the dealers return them to Bash for a refund. Alas, most hams today can't get their wheelchairs into the ham stores...or maneuver their walkers to the book department. Only the frustrated CBers are making it.

As far as I know, only *CQ* is carrying ads for these insidious publications. The FCC can make rules against them, but how can they be enforced? So Bash goes on reprinting the FCC exams virtually word for word, complete with the answers. He started out at FCC offices interviewing people who had just been through the exam, getting everything they could remember and writing it down. Today I think he depends on cards sent in by people who have just taken the exam. It's a sure-fire way of totally destroying the FCC test...and the fabric of amateur radio. These cheat-sheets have been so successful that a large percentage of the ham clubs who had been giving technical classes to prepare people to pass the test have given them up. Why spend the time and money on classes when you can memorize a few test answers in a couple of hours and fly through the exam?

In turn, this has been keeping newcomers to amateur radio from having to contact the clubs...and has further discouraged club membership. So we are seeing many of our ham clubs dying. Many are becoming geriatric events where doddering old-timers regale each other with tales of long ago triumphs.

If anyone out there really cares about getting amateur radio repaired, if anyone would like to see us be able to provide emergency communications, if you'd like to see us start turning out some new inventions and pioneering new techniques, if you are sick of the crap on our bands...then start *doing* something about it. It is up to *you.* Go down to your ham store and talk the owner into throwing out those Bash books. Tell *CQ* what you think of their carrying the Bash ads. Let's take some steps to make this a technical hobby again. Let's see what we can do to get hams back into building, experimenting, and pioneering.

Let's get our ham contacts more interesting by weeding out the CBers who never grow up. Let's get those technical classes in clubs going again. I want to be proud to be a ham...and so do you.

Carrie Nation...where is your spirit?

THE CD DEBACLE

My editorials on the almost non-existent state of Civil Defense in the United States have apparently fallen upon apathetic and uninterested eyes. I've had virtually no response. Trying to get some life into this desperately needed service is like trying to move the *Queen Mary.*

To go back briefly over the situation: As part of the SALT agreements our politicians, with their usual wisdom and foresight, made a pact with Russia setting up the main nuclear deterrent as Mutual Assured Destruction (MAD). We agreed to not protect our cities and people and Russia made the same pact. Fine idea...if they blast our cities, we'll blast theirs, and no one wins.

As usual with Russian agreements, the first step to implement it was a massive building of nuclear bomb shelters throughout Russia. Well, they've done well with this. If you ever read any news more than the ball scores, you know that the Russian shelter system is an accomplished fact. Perhaps it is time to go back and change MAD to AAD, American Assured Destruction.

It is unlikely that our present government is going to do anything serious to revitalize Civil Defense. They're fighting to cut expenses, not generate them...fighting against the massive social reform expenses. A recent study of Sweden on PBS showed the result of socialism carried to the extreme. Depressing.

Amateur radio has never depended on the government for support. The fact is that in just about every case you can mention, the government has hurt amateur radio when it has meddled with it. Left to our own resources, we would have a much larger amateur radio service, would be years ahead in technology, and our country would not have been passed by

---

NEWS FLASH

On February 17, the Federal Communications Commission approved the release of a Notice of Proposed Rule Making and Notice of Inquiry that could result in a substantial expansion of the amateur HF phone subbands. The Commissioners propose to expand the present 20-meter allocation by 50 kHz, giving General, Advanced, and Extra Class amateurs phone, SSTV, and facsimile privileges from 14.150 to 14.200 MHz. The docket, which is labeled Private Radio Bureau 82-83, has a comment deadline of July 1, with reply comments due August 2. Along with proposing the 20-meter expansion, the Commissioners are seeking comments regarding the expansion of other US phone allocations. *73* will bring you the full text of PRB 82-83 as soon as it is available.

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Japan and possibly Russia in technology.

With amateur radio the only practical system for emergency communications, one might think that the government would be interested and perhaps even cooperative. But no, CD is a disaster in most areas of the country. Few CD officials have wanted to cooperate with amateurs, so there isn't much doing as far as organized CD communications is concerned. This has not stopped the CD officials from spending all of the money allocated to their areas, even though most, if not all, of the money is wasted.

We can bring some light into this dark area if readers with personal knowledge of what is happening in their communities will write and let me know. Let's bring this out into the open and see if we can't get some official pressure to improve the situation.

With or without CD cooperation, I'd like to see amateurs set up a national emergency communications system...one which would provide the communications which will be needed in case of the worst. Remember, if we don't have such a system set up and working on a daily basis when there is no emergency, it is not likely to be of much value when things are in an uproar.

With some guidance and leadership, we might be able to get many ham clubs to establish special emergency teams. We'll be wanting to provide communications not only between hams, but also have a system of communicating with most of the other civilian and governmental radio services. This will mean the establishing of emergency communications centers with their own power and equipment capable of operating on a wide range of frequencies.

If any clubs are doing this, we'd like to have some pictures and an article. This might encourage other groups to work along similar lines.

Or would you rather just ragchew and wait, hoping that the Russians will feel sorry for our unprotected cities and be nice enough not to take advantage?

KILLING THE WOODPECKER

Yes, the damned thing is a pain. And it isn't going to go away unless *you* do something about it. We already know what it is. We know where it is. We know

Continued on page 44

Well . . . I Can Dream, Can't I?

by Bandel Linn K4PP

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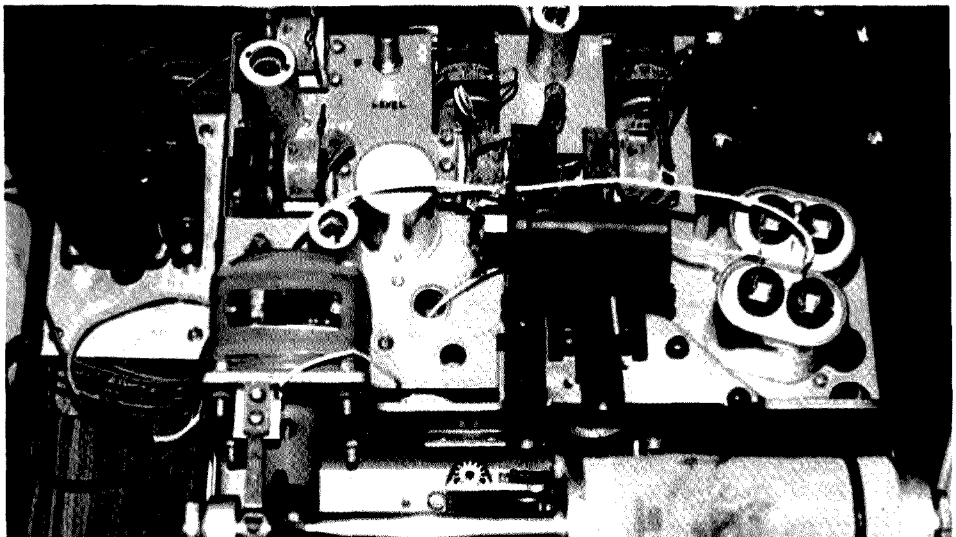
Watching the Weather

—a cheap and easy conversion



The converted fax unit. The autotransformer is to the left of the deskfax. The motor capacitors are shown between the drum and the power transformer occupying the area formerly used for the exciter lamp.

The Western Union deskfax offers an inexpensive approach to the reception of satellite cloud-cover pictures. This article describes a complete satellite receive system using the deskfax recorder. Little actual construction is necessary and the results can be equal to those of more complicated systems. The receive system and the fax display unit are separate elements and are discussed individually.

Receiver Conversion

The receiver needed here should be capable of FM reception somewhere between 20 and 50 MHz and should be tunable in order to compensate for Doppler shift. A receiving converter is used to bring the satellite frequencies within range of the FM receiver. Several radio sets which qualify are listed in Table 1.

All of the receivers mentioned in Table 1 sell for less than $35 and one of these or a similar receiver should be obtained first. Then it is a matter of selecting a converter with an output which falls within the tuning range of the receiver. The converter crystal determines this output frequency.

One attractive prospect is the use of a converter which reduces the incoming signal by exactly 100 MHz. A satellite signal transmitted at 137.45 MHz is thus converted to 37.45 MHz and the digit one is mentally added to the front of the receiver dial. However, it should be noted that receivers which cover 28-39 MHz usually sell for about ten dollars more than those which tune 20-28 MHz. In this case, the frequency conversion should be increased to 115 MHz for an output of 22 MHz. The converter should not change the satellite signals in such a manner that would permit interference from Citizens Band transmitters. That is, a frequency difference of 110 MHz should be avoided.

I use an R-108 military surplus receiver and a converter purchased from Hamtronics Co. The receiver is more sensitive than its BC-603 counterpart, but it requires a filament supply of 6 V dc at 6 Amperes as well as a 135-V dc B-plus supply. The R-108 does have some nice features to make it a worthwhile purchase. One is a fixed level of audio output that is independent of the speaker volume control. The fixed output can be fed directly to the deskfax recorder. A tuning aid in the form of an oscillator is also included.

A simple turnstile antenna, consisting of two crossed dipoles with reflectors, was made from a wooden mast and some ¼-inch aluminum tubing. RG-59 was used as feedline. This antenna provides excellent signals and good pictures can be obtained on overhead passes. Once the satellites have been heard, the orbit calculations are quite simple.

Some simple DXing and notetaking will reveal enough information for short-term predictions of the next satellite pass. Commercially-available satellite-tracking kits such as the one the ARRL provides for the OSCAR satellites are helpful in the initial efforts to understand orbital mechanics and the unusual behavior it imparts to satellite paths.

The Deskfax conversion system described in the text is pictured here. Although the deskfax is shown with the top cover in place, it is better to have the cover removed for actual use. The picture also shows the FM receiver and the converter, preamp, and power supply for the solid-state circuits.

Picture Display

The deskfax conversion is almost as simple as the receiving system. The deskfax unit is used essentially as is, with only minor modifications made for convenience. Since no type of transmission is desired in this unit, some of the transmit circuitry is disabled or removed.

Once the deskfax unit is obtained, a few operational checks should be made. The first check is to see that the unit functions when the incoming and outgoing buttons are pressed. It should be noted which of the relays operate in each mode, paying attention to the incoming function.

A relay marked LR, located near the back of the unit, must be operated manually as the incoming switch is pressed. A rubber band stretched around the LR contact wafer and attached to the 6AU6 tube, located between relays TR and ACK, provides a conve-

Radio Set	Type	Frequency Coverage	Notes
BC-603	military surplus	20-28 MHz	sold w/o power supply
R-108	military surplus	20-28 MHz	sold w/o power supply
BC-683	military surplus	28-39 MHz	sold w/o power supply
R-109	military surplus	28-39 MHz	sold w/o power supply
Radio Shack VHF Pro	police band	30-50 MHz	solid state, power supply included

Table 1. Possible radios for receiver conversion.

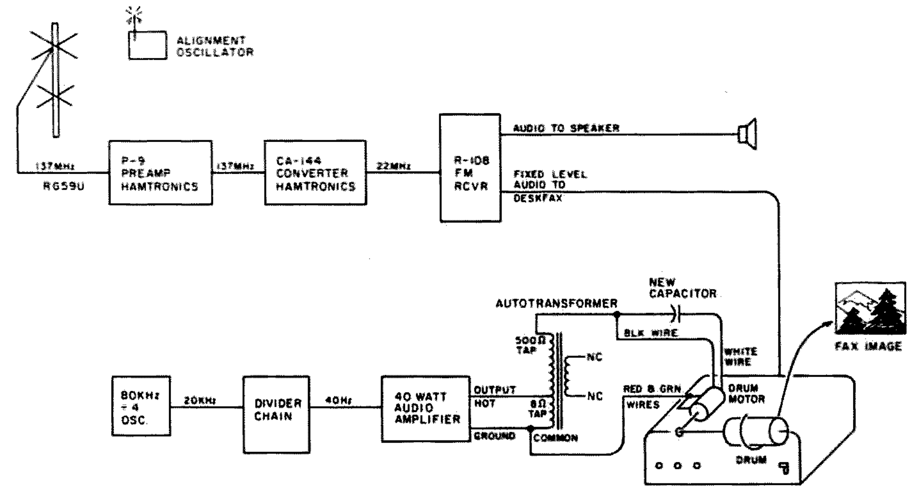


Fig. 1. Block diagram of the complete fax system.

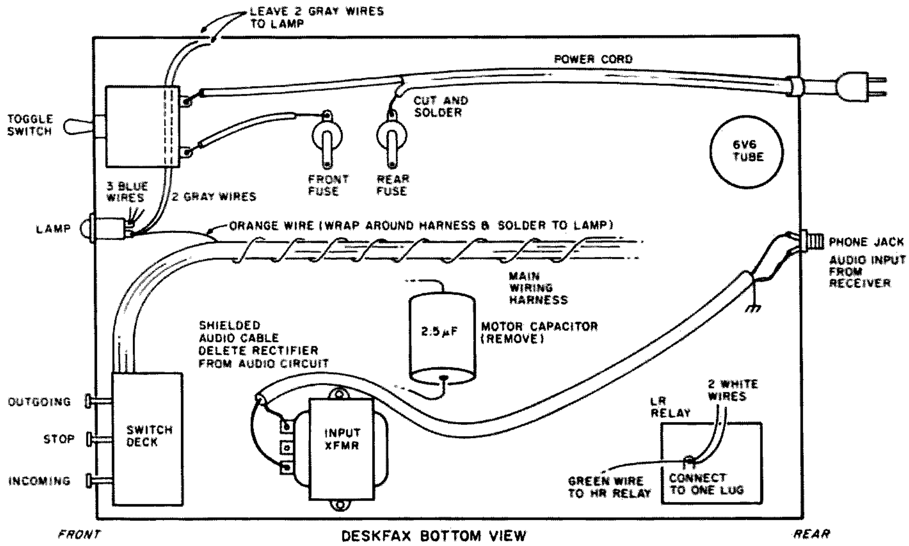


Fig. 2. A few simple wiring changes are needed to modify a deskfax unit.

nient way to anchor this relay into operation. Now relay PWR should close, and the 6V6 tube will start to glow. As the 6V6 tube warms up, a number 47 lamp in the B-plus power supply will also start to glow, dimly. The relay marked HR will close and the rotating drum will start to advance toward the opposite end of the fax machine. At the end of the drum's travel, a screw located on the forward end of the drum touches a post which shuts off the incoming switch deck, resets the relays, and allows the drum spring to return the drum to its original position.

If all this occurs, the unit is probably OK. If the 6V6 or HR relay fail to operate, check the cathode and plate voltages on the 6V6. The cathode should have 16-20 V dc and the plate should have 280-300 V dc. Failure to read these voltages indicates that one of the larger resistors in the deskfax is opened. The grid voltage on this tube is practically nil.

To the rear of the drum is the stylus arm. A small aluminum clip containing a steel wire stylus fastens to this arm. The incoming check should be repeated again, this time to verify operation of the stylus. With a piece of fax paper on the drum, begin the testing procedure again. At the rear of the deskfax, between relays LR and ACK, there is a pot listed as P1. After the drum starts moving, P1 should be advanced until the stylus begins to burn the fax paper. If the fax paper does not burn, try placing an audio signal across the end taps of the transformer located near the incoming switch deck. The fax paper will burn according to the intensity of the audio signal.

A new stylus, if needed, can be made from a steel wire cut from a wire brush or a wire wheel. It is not necessary to solder the new wire to the old stylus clip; merely route the new wire though the holes that are in the clip, then install it in the holder. Using this method, it is possible to attach a 2-inch-long wire and extract it toward the drum as it burns down. In this way, the stylus need not be changed so often.

Now the deskfax is ready for conversion. First, remove the wires that are connected to the coil of LR. Remove the buzzer and the ACK push-button switch. The orange wire which follows the switch deck harness should be attached to the ACK lamp and the jumper from the push-button to the lamp should be deleted. The short gray wire should also be removed. The ACK lamp will now have one side connected to 3 blue wires and the other side will have 2 gray wires and 1 orange wire. The ACK lamp will not light. A toggle switch should be attached where the push-button was mounted. Unsolder the power cord and move it farther into the chassis until one wire will reach the new toggle switch. Then solder that wire to one side of the switch. Trace the remaining wire back to the rear power fuse. Cut the wire there and solder it to the empty terminal on the rear fuseholder. Using the piece of power cord that was just cut off, connect the empty terminal of the front fuseholder to the remaining terminal of the toggle switch. This will complete the wiring of the main power switch.

Remove the exciter lamp assembly and its transformer. If you do not desire to manually operate relay LR, it may be left on permanently by soldering the contacts together or jump-

Reader Service for facing page ✓303→

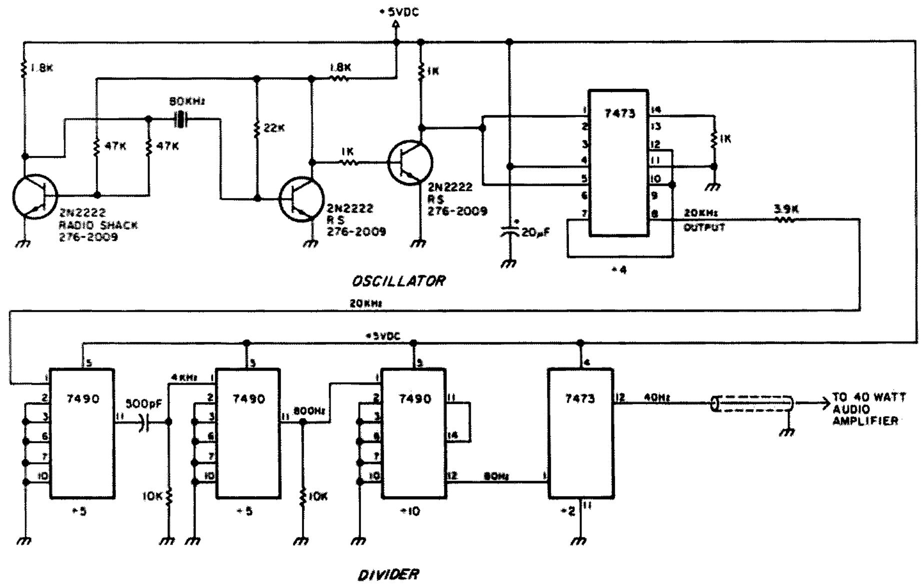


Fig. 3. This 40-Hertz signal source drives an audio amplifier which powers the deskfax drum motor.

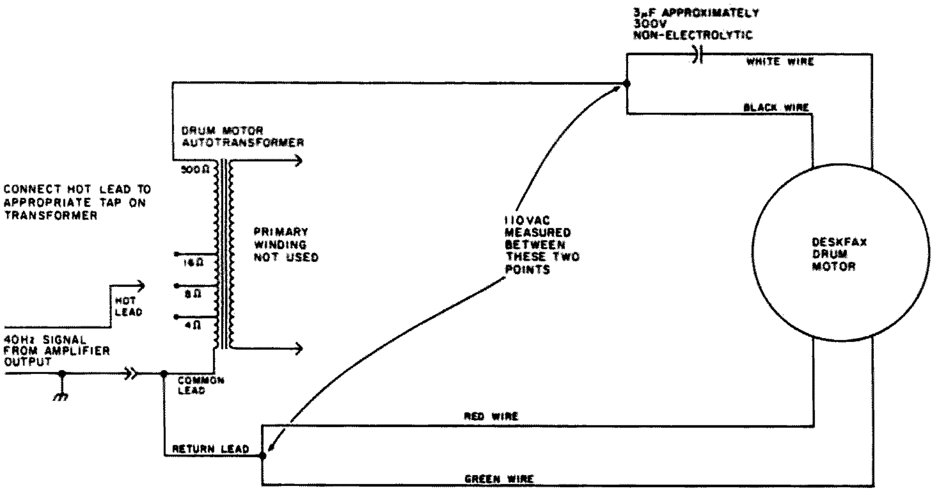


Fig. 4. The 40-Hertz signal from the amplifier is stepped up to run the motor. A dc voltmeter placed at the output of the amplifier will read approximately 12 volts going into the autotransformer. A lower voltage indicates the amplifier does not have sufficient output power to drive the motor.

ering them. The unshielded leads of the input line leading to the input transformer should be replaced with shielded audio wire. The original wire exited through a hole in the rear of the chassis. This hole will accommodate a phone jack very nicely.

Up to now the conversion steps described have been for the sake of convenience and could be bypassed if desired. But the final step is a must. There are four wires that lead from the gray drum motor located at the top of the fax machine. Trace these wires as far back from the motor as possible, then clip them loose. This should only be done *after* the fax machine checks out completely. The white wire will attach to a 2.5-μF capacitor located below the exciter lamp transformer and this capacitor should also be removed.

Originally the drum motor turned the drum at 180 rpm; this will not synchronize with any 120-rpm fax signals presently used on the satellite bands. In order to minimize the cost and complexity of fax systems, a plan was long ago devised which makes use of the existing motor by altering the frequency at which the motor operates. This is accomplished by replacing the 60-Hertz line voltage with one operating at 40 Hertz. This system is by no means new, but few details have ever been published on how to go about it. This approach becomes more desirable when fax units which operate at 120 rpm are priced.

My circuit consists of an oscillator and a divider chain which together produce a 40-Hertz square-wave output which is fed to an audio amplifier, where the signal is coupled to the drum motor through an autotransformer. A square wave is necessary for the divider chain to function properly.

The oscillator circuit was originally designed by Ken Cornell as part of a transmitter for the license-free 1750-meter band and was first published in the newsletter of the Longwave Club of America. It is with Ken's kind permission that the modified circuit is included here. The circuit was selected for its stable square-wave output. The oscillator and the divider chain both operate from a five-volt power supply. The Cornell circuit makes use of a crystal operating at 80 kHz and divides the signal down to the 20 kHz the divider chain requires. Since the oscillator circuit was designed for a much higher crystal frequency, it may take a few seconds warmup time to get the oscillator perking. A suitable substitute for Ken's design would be an oscillator operating at 100 kHz, divided by 5. Only the 80-kHz crystal and 7473 IC chip need to be changed. This should be considered if a 100-kHz crystal is more readily available.

The divider chain consists of a few components and a handful of ICs. The frequency divisions may be verified by monitoring the outputs of each IC. The 40-Hertz output is then fed to an audio amplifier. I used a tape recorder am-

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The Sinkhole That Ate Winter Park

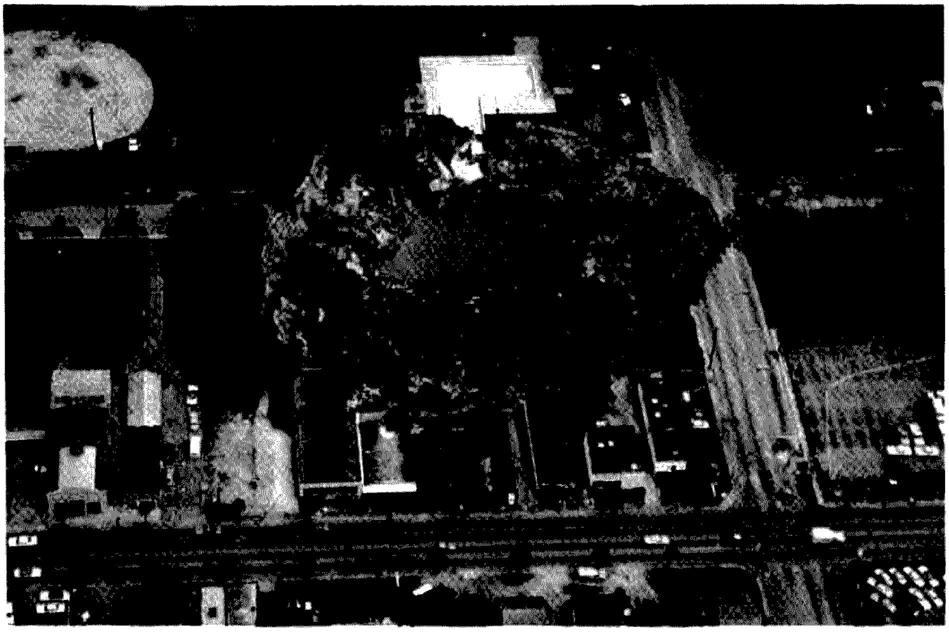
—hams vs. hole

When I locked the door to my business on the afternoon of Friday May 8, 1981, looking forward to a weekend of relaxation, I did not know that within 48 hours my faith in terra firma would be shaken forever and that my faith in the value of amateur radio would be renewed.

Winter Park is just across the city line from Orlando and right in the center of the state of Florida. The area is noted for the many lakes which dot the landscape. These lakes are fed from the massive Florida aquifer, a spongy, water-soaked limestone bed that lies under the whole central area of Florida. During times of drought, the water level falls and the porous rock can collapse. When this happens on a large scale, the resultant depression is called a sinkhole. It appears to be a monstrous crater to the center of the Earth which is devouring its surroundings. It is both frightening and, when occurring in an urban area, dangerous and disastrous.

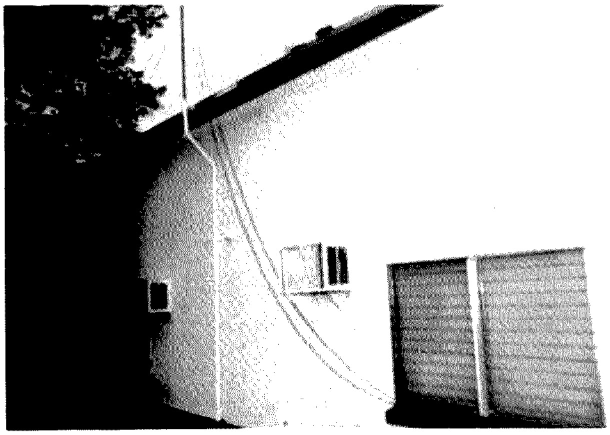
Early Saturday morning, I was behind my lawnmower enjoying the Fruits of Suburban Living, the Right to Life, Liberty, and the Pursuit of Crabgrass, when the ringing telephone offered a respite from the sun. It was an employee of mine, calling to find out if I knew anything about my shop's condition. She had heard that the area was sinking.

I called the police immediately, but they had no information to give me other than the fact that there was a sinkhole; they advised me to stay away. That same information was confirmed by a call to the Fire Department. I frantically called City Hall—no answer. Then a thought flashed in my mind and I raced to the shack, flipped on the 2-meter rig, and dialed up the local repeater. I called for a break, and there on frequency and at the sinkhole was a ham friend, Ed Cox WØRAO/4. He had just happened to be passing, noticed the emergency vehicles, and stopped for a look! Ed described the activities and area of involvement and then advised me on the best way to get into the area.



Armed with this information, I raced over from my home for an inspection. The area looked like a scene from a B horror movie. Fairbanks Avenue, normally the main east-west road through the town, had a six-block section barricaded. Many emergency vehicles skirted the perimeter. Police had established a crowd-control line. And there in front of the widened eyes of hundreds of spectators was a gaping cra-

Reader Service for facing page ✓15→



ter. One almost expected some primordial beast to rear its head from the depths. The pit was 400 feet across, over 150 feet deep, and contained a dry cleaning plant, a TV store, a print shop, six Porsches, and the back end of an auto repair shop. For dessert, it had eaten a three-bedroom house, parts of two streets, and an Olympic-size city swimming pool.

I stood in the front door of my shop—just 125 feet from the rim—in total disbelief. I had been a resident of central Florida for awhile and knew that although sinkholes were not too uncommon, this gigantic one was very unusual. A passing police officer said that three other smaller sinkholes had opened up elsewhere in the county.

As the crater began to assume a round rim, however, I felt that perhaps my property would be saved. And when a telephone utility worker came by and muttered that if a nearby main trunk line went, south Florida would be sending letters for a while, I got an idea.

Here was the prospect of a communication emergency and mounting national and international interest. I should set up a portable amateur station on my property near the hole! I also had easy access to the local geologist's temporary field headquarters, where complete factual information would be available on this and other sinkholes.

I made the ten-minute trip home and rushed into the shack. I wondered—what kind of antenna? What rig? What about power? I would have to homebrew an antenna. I grabbed some RG-58/U from a pile of Hamfest Fallout. I also found some 450-Ohm ladder line. In the utility room, I had a coil of Romex house wiring, scraps of stranded copper wire, and an old extension cord. I borrowed a marine battery from a neighbor. I was certain that I could do something with all this wire, but to be sure, I took the matchbox tuner. I also chose my tube-type rig (Drake R4B and T4XB) rather than my new solid-state rig because of the reputation of tubes in the finals during high swr conditions.

Finally, I took along my dummy load, a ham's most important device. I knew I could tune the rig with the known 50-Ohm value of the dummy load.

My station wagon looked as though I had just come from a binge at a hamfest. My XYL came running down the driveway with a D-104 mike and a CW key. She advised, "Be careful, Honey, and you need these, don't you?" I could see bits of tears in her eyes, and, had I waited, I think she would have renewed her pledge to get her ham ticket.

As I drove back to the shop, I heard national network news on a local station exclaim, "And in Winter Park, Florida, a massive sinkhole continues to swallow the business district. . ."

I screeched to a halt in my parking lot and assembled the gear in the front room of the shop. In the office, I had a fresh copy of the May issue of *73*, and there in the pages was an article on coaxial dipoles! I fished out the RG-58/U and home-brewed a 20-meter coax antenna. My emergency mast was a piece of 1 × 2 wood stuck down in the toilet vent pipe on the roof. I taped the center of the dipole to the mast using duct tape and used twine to support the ends, one strung from a tree limb and the other from my business sign. The feedline came in through a window.

A quick hookup to the power supply, and the tubes began to glow. The antenna worked! I heard the reassuring crackle of CW, then a fast load-up, and I was on the air. The band was down at the time, but I was reaching New York and the midwest with 599 signals. My Advanced class ticket was barely a month old, so I went up to the phone bands.

During the next several hours, the amateurs I contacted by CW and phone were very interested in the facts about the sinkhole and surprised that there was an amateur station so close to the event. They asked about relatives in the central Florida area, and we would tell them what we knew about the other sinkholes as well as ours. Several amateurs were concerned about their properties in Florida, and we provided information regarding water rationing in southern Florida as well as on sinkhole damages in the central areas.

Two days later, the geologists and city officials felt that the massive hole was stabilized and only minor expansion would continue. They decided to open Fairbanks Avenue, but for pedestrian traffic only. The crowds were huge. The Great Winter Park Sinkhole became the number one attraction in central Florida. We estimated that over 35,000 people flocked to the area to see the awesome sight. I made some quick arrangements with a T-shirt firm and reopened my business to cater to the crowds. On the front counter remained my portable rig, and we continued to operate, to the delight of the crowds.

I was forced to remain in my building for long hours during the initial collapse phase so that I could respond to the city engineers and be informed of the status of my property. After

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the worst was over, I decided to experiment with the variety of materials I had and see just exactly what I could accomplish in antenna design with the barest of essentials.

I was pleasantly surprised to find that almost anything can be made to radiate. The antenna tuner was worth its weight in gold. Using coax feedline and standard dipole lengths, I constructed radiators from stripped Romex house wiring, lamp cord, and even a piece of transformer winding. The most novel was a length of kite-string doused with salty water! We assembled it on the roof and sponged on the brine. It loaded up fine, but then the swr meter went crazy. The observer on the roof yelled down, "Hey, the water is drying up!" Either the hot sun or the rf was evaporating the salty solution. We tried loading the string again at night, but evaporation was still rapid, so we never did conclude what the real culprit was. Perhaps it was a combination.

One fascinating observation was made with an end-fed zepp. The capacitance of the antenna and tuning values seemed to follow a slow shift while operating during the day and evening. I was baffled. The 40-meter antenna hadn't moved, we hadn't readjusted the rig, and nothing seemed to have changed. Late in the evening, however, a geologist was updating me on the hole and mentioned that the water was slowly rising in the bottom of the sinkhole. Could it be that the capacitance to ground had been changing and it was detected by the tuning values of the antenna? Since the level of water in the hole was the basic level under the building and antenna also, perhaps we had discovered a way of measuring the water table using antenna values!

There did seem to be a correlation, and the head geologist was excited about the prospects. This was real ham radio—experimenting, learning, and discovering!

On the operational side, I learned a lot of things since most of the time I was in the middle of a pileup. I found it difficult to write down the calls and reports and work the PTT button or the key. I soon developed the skill of writing with the right hand and working the PTT with the left. A footswitch would have been nice!

I gave up on VOX action due to the local noise level. On phone, rather than working one station at a time and then calling QRZ, I copied down all the calls I could hear within about 10 seconds and, as the action died down, repeated their calls. As soon as I had a list of a dozen or so, I worked each of the calls on the list. I found this system to be much more efficient than creating a shouting match after each call. On CW, I found the operators to be a little easier to work. I also discovered that the pileups occurred on CW down around 14.025 to 14.030, the secret hideout of the fluent CW ham.

To encourage participation with us, we developed a certificate, the W.A.S., or "Worked All Sinkholes." This bit of wallpaper served as a QSL and as an item to create interest.

Armed with a hemisphere map, I began to plot areas where our signal was reaching at various times of the operation. Sure enough, you could see the zones as the reports came back to us. I reconfirmed that by raising the antenna one lowers the angle of the radiation and thereby changes the area of coverage.

I continued to learn things back in the shack. I began to make lists of the things to remember during portable operation: Remember a box of spare fuses! Don't smoke around a battery; the bubbles are hydrogen! When you do run an ac power line, tape it down so that you don't trip over it. Little pieces of colored tape help to code things such as ground wires, coaxes, and connecting cords. Be sure to log all third-party traffic. Be as neat as possible on your main log or you find yourself wondering whether it was a U or a V, and what was that other letter?

I was amazed at the reaction of the general public to the operating amateur station. They seemed interested in the phone operation and somewhat confused by the CW. Using very unscientific sampling methods, the "sinkhole poll" showed that fewer than one in ten realized we were operating an amateur station. Only those who had a relative or friend in amateur radio understood the capabilities of amateur communications.

We did find spectators who were fascinated and very interested, however—maybe two out of ten people. Many were youngsters and teenagers. We furnished the names of several local amateur clubs, a local supply company, and magazine addresses. We wished we could have offered them more information. It is our opinion that amateur radio needs to do much more self-promotion and training of interested newcomers. The type of high-visibility operation that we carried out is a useful technique for raising the level of awareness of amateur communications in the general public.

As a final note, I must say that the sinkhole experience has been one of the most rewarding events of my life, and I am happy that amateur radio was a big part of it. I used to dream about the thrills of a far-off DXpedition and some remote island with waves crashing against a rocky beach.

There I was, in a tent, with the rigs fired up. As I sipped on coconut juice and stared at the big beams on temporary masts, I could hear half the amateur radio world calling me, amidst the cries of the seagulls! Ah, what a life!

Well, now I agree with Dorothy when she told the Wizard of Oz that she had learned her lesson. If I ever go searching for someplace special, I need only look in my own backyard! Sooner or later we will all get a chance to be in the middle of action, and we need to be prepared. Your chance may be next! ■

The Special Sinkhole Crew Advisers and Helpers

Joe Lewis WB4WPP	Ed Cox W0RAO/4
Gilbert Potyandy K4ISK	Jack Leavitt KA4ATV
Dan Martin KC4GO	Fred Hopkins N4EDM

Joe Lewis demonstrated his skills at a pileup that he learned while in Saudi Arabia as a field technician. Gilbert kept the rigs in repair and offered his technical skills. Danny Martin claims he is going to patent his special Toilet Vent Mast! Ed Cox first spotted the hole, and maintains the 2-meter link. Jack Leavitt and Fred Hopkins kept up the local interest and worked on the certificate.

The schedule now is sporadic, but normally is around the lower end of 20-meter CW (General portion) and 20-meter phone. To offer Novices and Technicians a chance, we work the lower end of 40 meters and 15-meter Novice CW. An SASE will get you the regular schedule by the month.

—Reader Service for facing page ↙81↗

Operation Skywarn

—tracking tornadoes with two meters

Bill Richards WB5ZAM
1925 Juanita St.
San Angelo TX 76901

The following is a true and factual account, to the best of my recollection.
Time: 1900 hours local, on a partly cloudy day in late May.
Location: San Angelo, Tom Green County, Texas.
Frequency: 146.34/.94-MHz repeater.

"Well, guys, I'm tired and both my batteries and the ones in my talkie need a good night's recharge, so I'm going to pull out. If that cloud to the west looks like it's going to do anything, holler. I'll have the radio on but just monitoring. KA5BNJ and the group, this is W5FZY clear, adios."

"OK, Elmer, we'll see you. W5FZY clearing, this is KA5BNJ. Pick it up Noel. WD5BHX, this is KA5BNJ."

"Break! Break!"

"Go ahead break-break, this is KA5BNJ."

"Sorry to interrupt, John, but the Weather Service just issued a tornado warning for the western part of this county and Irion County [directly to the west of Tom Green County]. At 6:45, DPS [Department of Public Safety] reported a tornado on the ground 10 miles north of Mertzon [25 miles southwest of San Angelo] with an apparent northeasterly path. If you don't mind and there are no other volunteers, I'll go ahead and assume net control and activate the Skywarn Net."

There were no volunteers.

"This is WB5ZAM assuming net control for the Concho Valley Severe Weather Net. Do we have anyone on who has information for the

Is this a tornado? Members of the Concho Valley Severe Weather Net were not sure, but they kept a close eye on the ominous clouds.

net regarding the severe weather in the Mertzon area? If so, please call net control, WB5ZAM."

"This is K5JEZ Mertzon. Bill, we've got winds at 30 to 35 miles per hour from the west and northwest, with light rain. We aren't able to see very far to the north, but there are two large thunderheads to the west and northwest of me."

"This is W5RSV mobile, and I'm about 10 miles northeast of Charlie, and those clouds he's talking about are really building fast. It hasn't started to rain or blow here yet but those clouds are very dark and it does appear to be raining over towards Mertzon."

"Thanks, Charlie and Marion. This is WB5ZAM, net control for the Concho Valley two-meter Severe Weather Net, do we have any other reports of severe weather or anyone who can go to the Weather Service and man the station there? If so call WB5ZAM, net control."

"This is WD5BHX. Bill, if no one else can go, I'll be free here in a little bit and will go out, but I'm handie-talkie portable in the mall now. WB5ZAM, this is WD5BHX."

"Thanks, Noel. Is there anyone able to man the station at the Weather Service, please call now. If there are any other reports of severe weather, please call now. This is WB5ZAM, net control for the Concho Valley Severe Weather Net."

No volunteers spoke up.

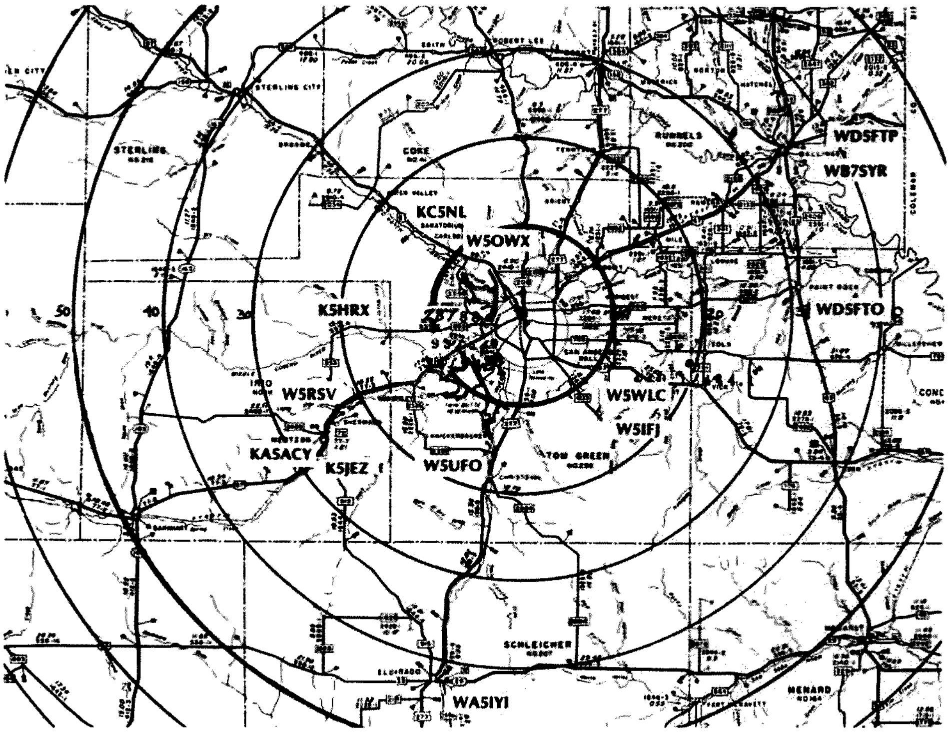
"No takers. Would you mind, Noel? I know Art could use someone experienced with the rig and the net."

"We'll be en route very shortly. WB5ZAM, this is WD5BHX."

"Thanks, Noel. Do we have any other net members with reports of severe weather only? Please call net control, WB5ZAM."

"KA5BNJ."

"W5OWX."



San Angelo, Texas (Tom Green County) and surrounding counties, with the locations of local hams. The rings mark ten-mile intervals from San Angelo.

"Break. This is Art at the Weather Service, W5QX."

"Go ahead, Art."

"Gentlemen, we have a tornado sighted by a DPS trooper, 10 miles north of Mertzon with an easterly path. We also have a line of thunderstorms of marked severity extending from 20 miles northwest of Mertzon to 20 miles west of Ozona, with a path of movement to the east and northeast at 20 miles per hour. These contain heavy rain and hail and do indicate tornadic-type winds aloft. This is W5QX."

"Thanks, Art. We have activated the net and Charlie reports 30- to 35-mph winds with light rain at Mertzon, and Marion reports light winds without rain 10 miles northeast of him. He does report heavy thunderstorms to the west. Thanks for your information and we do have someone on the way to man the radio for you. W5QX this is WB5ZAM, net control for the Concho Valley Severe Weather Net. Do we have—sorry, John, KA5BNJ."

"Bill, we have light rain and a westerly wind at 10 to 15 miles an hour here at Carlsbad [20 miles NW of San Angelo]. WB5ZAM, this is KA5BNJ."

"Thanks, John. W5OWX, WB5ZAM."

"Bill, the weather is about the same here, but I can hear thunder to the west and northwest of me, here in Grape Creek [12 miles NW]. WB5ZAM, this is W5OWX."

"OK, Al. This is WB5ZAM, net control. Do we have other check-ins with severe weather reports only? Please call WB5ZAM, net control."

"This is K5JEZ."

"Go ahead, Charlie."

"Bill, the wind has changed to the west and northwest, at 38 to 40 miles an hour—no, there's a gust to 50 miles an hour, and we have heavy rain now. If I lose power, I'll go to the mobile and be right back. WB5ZAM, this is K5JEZ Mertzon."

"OK, Charlie. Art, did you copy? W5QX, WB5ZAM?"

No response.

"WD5BHX?"

"Yes, Noel?"

"Bill, I'm en route to the Weather Service now. Art probably heard that report but was unable to reply as he went back to the radar. I'll have the radio manned very shortly. WB5ZAM, WD5BHX."

"OK, Noel. This is WB5ZAM, net control for the Concho Valley Emergency and Severe Weather Net. Do we have other reports of severe weather?—and if not, we'll begin taking check-ins from portables and mobiles, then we'll come back to the fixed stations. This is WB5ZAM."

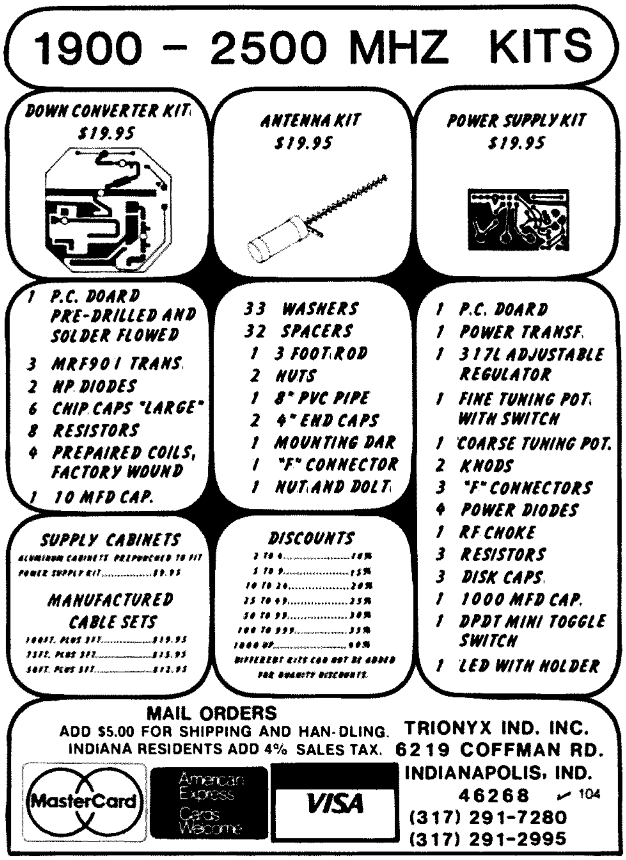
"W5RSV."

"K5JEZ."

"Yes, Marion?"

"Bill, the winds are buffeting the pickup pretty good now and we have a very heavy downpour here. Over."

"OK, I'll note that to Art. Go ahead, Charlie."



"Yeah, this is K5JEZ. The rain has let up some, but it's still pouring and the winds have settled down to 25 to 30 miles an hour, out of the west."

"Thanks, Charlie. K5JEZ and W5RSV, this is WB5ZAM, net control . . ."

And so it went, with thunderheads building to the west and southwest and moving in our direction. We had 46 check-ins: 18 portables, 12 mobiles, 14 fixed, and 2 via telephone, and we watched clouds for just over three hours as they built up and then dissipated.

This quick response on the part of local amateurs was not due to our working as communicators, but due to the weekly practice sessions, where everyone gets a chance to check in, test antennas, and even call the net, to get the hang of calling up the group and maintaining the net. From mid-April through mid-June, we get the real thing with frequent storm development and the possibility of severe weather developing. We watch not only for the Weather Service-NOAA, but for ourselves, the local media, and (you would be surprised who listens to the repeater frequencies during severe weather!) the numerous shortwave listeners.

Due to the size of the area we need to watch for threatening storms, we in the Concho Valley have tried to get the best repeater coverage possible and to keep all amateurs informed of the frequencies and nets. Our net members include lawyers, nurses, ranchers, retirees, salesmen, housewives, Armed Services personnel, executives, and college students. We will have check-ins from as many as 70 air miles away and as close to the repeater as two blocks. The storms that affect us can build near Ozona (70 air miles southwest), or to the northwest (near Carlsbad or Sterling City), or sneak up on us from the east, from Paint Rock or Ballinger, and can include everything from rain and wind to hail, high winds, and tornadoes.

Basing our techniques of cloud-, wind-, and rain-watching on the training provided by NOAA's National Weather Service, we are able to provide accurate information to the Weather Service and hence keep it aware of conditions on the ground under the clouds, an area where the Weather Service radar cannot tell the difference between blowing dirt and hail. To date, we have provided not only basic information on the storms but also have been able to act as indicators of the severity of storms, including the severity of the winds and actual amounts of rainfall. We also have been able to give aid when the radar at the Weather Service was inoperable, giving warnings of high winds and hail as a cell moved into the area.

We found that the best way to keep everyone current (as to who lived where in our area) was to publish a directory of local hams and take a highway department map and overlay it with concentric rings, approximating by tens the aeronautical miles from San Angelo. The map also has the sites of the three 2-meter repeaters and the site of the 450-MHz repeater. We then took the maps and used them to coordinate tests on the emergency-powered repeaters so as to test where we could reach the repeaters with what level of equipment (i.e., with a one-Watt handie-talkie, or 10 or 25 Watts, or if a directed array was necessary). All net and club members then were given maps, a list of current net check-ins, and the opportunity to call up the net in the weekly practice sessions.

Since the storms take fairly consistent paths, we found that a map showing the area southwest and west would serve better than a true circle around San Angelo. The map gives the net control an idea of who lives where in relation to a storm cell, and net control thus is able to ask these specific individuals for information on the cell, whether it is moving toward them, away from them, or around them. Then the net can ask for mobile stations to move to points paralleling the projected path of the storm. Since we have only about 60 amateurs active on 2 meters, this map gives the net control an idea of where each member is—especially those in the outlying towns.

The continuing improvement in the educational services from NOAA has helped to train more and more amateurs in the Skywarn system and has increased the number and accuracy of reports during the severe weather months. We also installed equipment at the Weather Service, giving them ready access to the net frequency, and have worked with them to get amateurs into the Weather Service during inclement weather to give them a trained communicator to exchange information between them and the spotters of Operation Skywarn.

So, the next time you hear a net call-up on 2 meters (or if you haven't tried 2 meters), go set your FM public service receiver or scanner to the net frequency; when the next severe weather system blows in, you can watch the storm through the eyes of others and know whether you are going to get a springtime shower or a frog-strangler. You, too, may want to join the "professional" amateurs on the Severe Weather/Operation Skywarn nets and help keep an eye on the storms. ■

Ben Johnson
77 Ridgeway Avenue
Rochester NY 14615

Measure Ohms with Your Calculator?

—yes, and accurately, too!

Undoubtedly the dumbest electrical measurement made on a multimeter is the one on the high end of the Ohms scale, where the figures are so crowded together that what you read is more a matter of faith than reality. And then there's the zeroing problem—was the meter zeroed when you started?

Now, at last; there's a better way that doesn't crowd readings or require rezeroing . . . a linear, digital ohmmeter with great high-resistance sensitivity that exceeds the 20-megohm limit of many commercial digital multimeters!

But the best news is that you can put it together yourself in a cheap pocket calculator! Nowadays these little four-bangers are frequently on sale for less than the cost of their individual parts. This amounts to the manufacturer doing most of your assembly work and providing a professional-looking, compact case as well. Try agonizing through the alternatives and you'll quickly see what I mean in terms of the cost/benefits ratio. All this

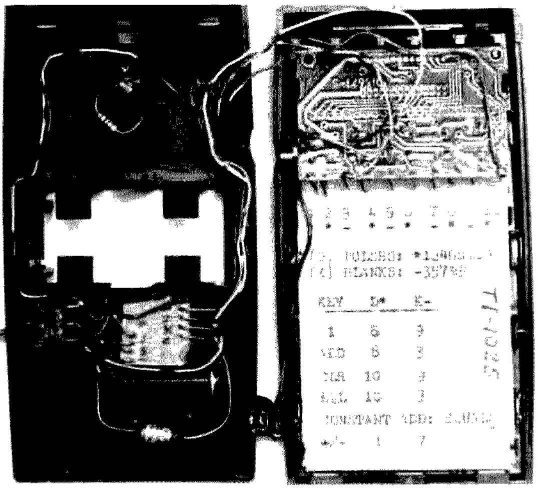


Photo A. Clamshell view of the completed calculator transformation. The final range capacitor is a 1-microfarad tantalum between switch and module. Just four wires connect to the calculator circuit proper; they were left long for strain relief. The assembly is ready to be closed up and used.

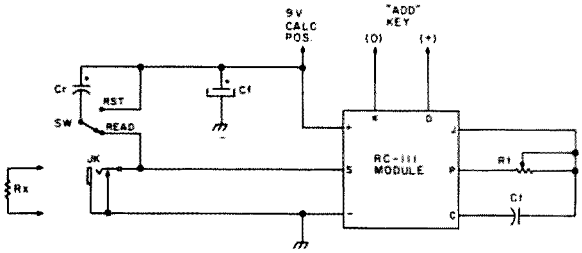
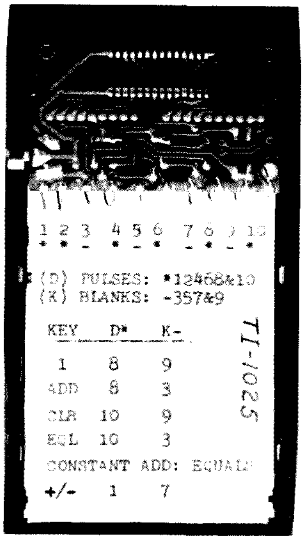


Fig. 1. Circuit for converting calculator to measure resistance.

Parts List for Fig. 1

Cf—Filter capacitor, 10-100 uF, electrolytic
Cr—Range capacitor, polyester, 1-2 uF (see text)
Ct—Timing capacitor, polyester, .05 uF
Rt—Timing resistor, minipot, 1 megohm
Rx—"Unknown" or calibrating resistor, 1 megohm, 1%
JK—Phone (test) jack, miniature, w/plug and test leads
SW—Switch, SPDT, miniature, bat-handle toggle
Above parts are readily available from normal sources.
RC-111 Module—Available from Kaltek, Box 7462, Rochester NY 14615 ($14.62 ppd., plus NY state sales tax if applicable).

Photo B. Ten wires connect the keyboard to the calculator chip/display board. An oscilloscope from ground to each wire in turn identified the wires carrying digits pulses. The scope between each of these wires and each of the other "keys" wires showed which key joined each pair. The table shown cracks the code for the keys of interest. The module connects to the constant-add pair, numbers 10 and 3.



is now made possible by a newly-available module that begins where the calculator manufacturer left off . . . and does lots more.

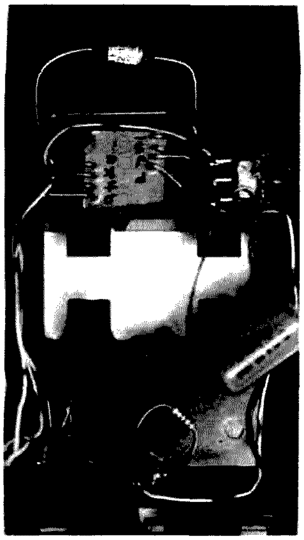


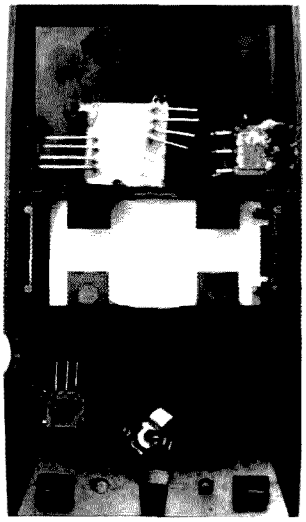
Fig. 1 shows the simple circuitry needed to transform your four-function, constant-add calculator into a *pièce de résistance*. So few parts are required that the whole addition almost invariably will fit completely inside the original case with room to spare. With simplicity like this, even the nicety of a printed circuit board is not worth the extra time and effort. The only external bits of evidence that your new instrument does more than calculate are the actuating switch, the test jack . . . and the smug look on your face when your friends see it do its stuff. You may, of course, want to exceed the bounds of the original case, but later.

How It Works

The brain of this little circuit is Kaltek's RC-111 hybrid CMOS module with eight leads emerging from its 2×2×1 centimeter package. It utilizes the familiar time-constant principle to determine the value of the resistor under test. The calculator is caused to count and thus act as a timer to measure the time it takes for range capacitor Cr to charge through the unknown resistor, Rx. The counting function stops at a certain charge level on Cr as sensed by the high-impedance input (S) of the module.

Photo D. A 10-megohm resistor was soldered across the jack as an internal reference, and a 2-uF range capacitor (blurred) was temporarily enlisted to give a 20-second time constant for setting the counting speed. At top speed, the count was about 220 for the ten-megohm resistor, indicating that the range capacitor should be 1 microfarad and the timing pot slowed down for a count rate of 100,000-Ohms-per-count. The module lead identity is cast in the sides of the package; they were transcribed on the facing surface for clarity.

Photo C. The main fixtures—module, actuating switch, test jack, and count-rate pot—are stuck in the bottom of the TI-1025 case with hot-melt glue. This stuff is handy and can be cut off the stick and melted in place with your soldering iron. You don't need to buy the glue gun for the job.



The counting rate is adjusted by the combination of Rt and Ct, so what shows up when the display stops counting is a number equal to the value of Rx, with various numbers of decimal places determined by the size of Cr. Your personal intervention merely involves clearing the display and entering an initial "1" to count from, then flipping the actuating switch. Your calculator retains, unimpaired, all of the original functions it had, when the display is not running or when the test leads are removed to short the jack. If you have any parallel- or series-resistance calculations to make after the display shows the value of your unknown, you are immediately ready to make them on the keyboard.

Construction

There's really so little to do that the circuit diagram tells it better than words. About the only precaution is on behalf of the CMOS-based RC-111 module, which, although protected as well as functional requirements allow, should be handled so as to avoid any exposure to static electricity. That is, ground yourself and your (non-transformer) soldering iron before touching the module leads. Once it's in the circuit, it's rather safe (if wired as shown, of course).

For openers, wire the module separately as shown, with the leads uncut. Their functions are identified on the case. You need to start from some convenient known condition. For calibration accuracy, a 1% resistor should be chosen, somewhere around one megohm. For ease of handling the corrective arithmetic, use a 1-microfarad capacitor for Cr, of any tolerance. Chances are that you'll have to change or pad it later, any-

Photo E. The only things showing externally are the jack and switch . . . and your own look of satisfaction! The author plugged a photocell in the jack and used the freshly-built instrument as an enlarging exposure meter to make these prints. Only an initial test print was required to get the range.

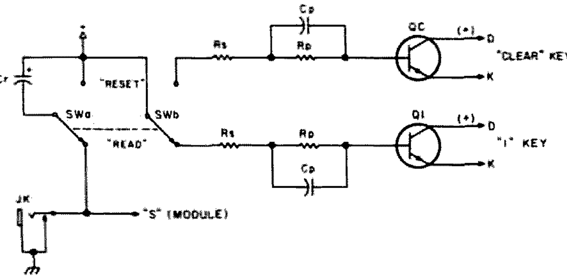


Fig. 2. Optional circuit to actuate CLEAR function, enter 1, and perform the READ function all from a DPDT switch.

Parts List for Fig. 2 (see text)

Rs—.5 to 1.5 megohm, ¼ W
Rp—10 to 22 megohm, ¼ W
Cp—.01 uF, ceramic, 10 V
QC,1—NPN silicon transistors, general purpose
SWa,b—DPDT toggle switch (replaces SPDT of Fig. 1)

how. The pot (Rt) should be at the high-resistance end of its span to begin with.

Now get intimate with your calculator. For the easiest trip, choose from the National Semiconductor Corporation's NOVUS 600 series or their private brand equivalents that now carpet the terrain like transistor radios ("Mathbox," for example). Some have fixed or switched-on decimal points. All have the necessary constant-add function, which means that if you enter a number and repeatedly punch the "ADD" key, the number will be added to itself in the display. Other brands with this function are also good contenders, but these are easy to find, cheap, and very cooperative. The earlier ones have an 18-DIP chip for the calculating, designated MM5736; later ones have the same characteristics, but the chip is buried under a plastic glob on the flip side of the display board.

Some have LED drivers, and some don't. That aspect doesn't matter. What does matter is how easily you can find and identify and polarize the leads from the CLEAR, 1, and ADD keys. The calculator can be a junk-box habitué, and many are by now for various reasons. If yours failed mechanically on the keyboard from bad key contacts, you still can use it for an ohmmeter and inject new life into the old box. For a DIP-cased MM5736 chip, the needed pin identifications are in Table 1.

The shared pin in Table 1 is coincidentally a result of the matrixing of the keyboard; all keys are shared, but you won't need the rest. Chances are if you are compelled to poke around looking for the needed ones, though, you'll find at least half the others first (in which case, if I didn't forewarn you, you might be non-plussed—minussed, even—to discover all these funny coincidences yourself).

If your machine isn't old enough to have pins, take a 10k-Ohm resistor and use it to jump the various keyboard leads you can spot, with a number entered in the display for you to watch the results on. Or, put your scope across the leads and poke the keyboard until the scope signal shorts. A standard ohmmeter used with calculator power off would do the same thing, but I hesitate to recommend putting its voltage, however low, on a dead section of the chip. The whole process only takes five or ten minutes with a resistor, and it's harmless. So try that method first, and as you identify the leads and determine their polarity from battery negative, mark everything down with a diagram to help you relocate the right ones later on.

Key	Pins	Called	Most-Positive	Remarks
ADD	1-3	D4-K3	1 (D4)	All "D" pins generate positive pulses to the K pins. ADD and CLEAR share pin 3 (K3).
1	4-17	K1-D2	17 (D2)	
CLEAR	2-3	D1-K3	2 (D1)	

Table 1. Pin identifications.

To recapitulate, at this stage you should have found your needed keyboard leads, identified their polarities, and have the module circuit wired and ready to connect to the calculator for temporary initial testing and calibration. With the power off, hook the module plus and minus leads to the calculator power points and set the module circuit switch to RESET, shorting the range capacitor. Now you're ready for the fun part, and you should make sure your battery is reasonably fresh, or else use an adapter. The MM5736 chip needs at least 6.5 volts to operate, but the module needs .5 volts more, so stay above 7.0 volts during testing.

Initial Testing and Calibration

Power up the calculator, clear the display, and enter a 1. Flip the module switch to READ and note that the display starts counting up from 1 and soon comes to a halt. You should then be able to enter more digits via the keyboard. Press CLEAR twice, enter 1 again, and flip the switch to RESET and then READ. Again the display should rack up about the same bunch of numbers.

So far, so good. Now you have proved that things are in working order and you can start shooting for the fastest counting rate your particular calculator chip can deliver. While alternately RESETing and READing the switch, twist your timing pot (Rt) towards minimum resistance to speed up the counting rate. You may get up to the magic limit of about 150 counts/second, but on average you'll hit around 60 before the display starts doing strange things like hesitating, stopping, showing EEEEEE, or otherwise not counting at a nice even clip. Back off on the pot setting and start over, babying up close to the forbidden point. Once you've found it, try timing the counts per second with a sweep second hand clock and record the results. You can do this most easily by leaving the switch at READ and putting a jumper across Cr, the range capacitor. That'll keep it running constantly.

So much for high speed; now you need to adjust your range capacitor so that the displayed number is a few counts higher than the value of the calibrating resistor... probably within a couple of decimal places. Say your Rx is one megohm and your count is 50 when it stopped running from a "1" start. That means you need to double your Cr value from its nominal one microfarad to extend the time to total 100 or more counts. Pick a combination of good capacitors for Cr that gets you there and a little beyond when paralleled with Cr. Run a few check counts, and then slow the count rate with the pot until it matches the calibrating resistor value. You should now have the best combination of high counting

speed and as much resolution as your chip can deliver.

For practical purposes, you are now ready to make a neat mess and pack it into the calculator-cum-ohmmeter. You may, however, want to consolidate your pile of add-on capacitors into the fewest number that will do the job. Try to stick with polystyrene or polyester caps to minimize dielectric absorption, which tends to throw off your first reading. Or else learn to accept the first reading and ignore any changes in a rapid retest of the same resistor. In any case, recheck your calibration once everthing is mounted permanently in the calculator case.

Locate the switch and test jack for your convenience; a thumb-actuatable position on the side of the case would work well for the switch, while the jack might be placed on the opposite side, consistent with the stuff already in your own calculator.

Error Sources

Over the 7.0-9.5-volt operating range you'll see a readout variation of about plus or minus 7%, which is quite adequate for most applications. If you wish to tighten up the precision, a zener diode with a bleed current of around 30-40 mA across the whole circuit—calculator and module—will hold variations to a couple of percent or less. This is rather tough on the battery, so an ac adapter should be considered, preferably with zener stiffening if you want to go all the way for precision. The slight error from the nature of the range capacitor dielectric has been mentioned; it's not big, but it's hard to avoid.

Real super capacitors carry a real super price tag; if you're that fussy, maybe you should send your unknown resistors to the National Bureau of Standards. Ceramics are compact and cute, but their capacity/voltage effects are impossible; forget them. If you intend to use large capacitance values for Cr in order to read low resistances, you should stick to tantalums and timing-grade types, if you can. Regular electrolytics will be quite hopeless for a good instrument. For 1000-Ohms-per-count, you'll need some 10-20 uF; for 100-Ohms-per-count, then about 100-200 uF would be required and your decade-matching problem would get a little sticky. At some level, you should best accept what your analog multimeter can deliver for the low resistance readings, to avoid fighting the uncertainties of large capacitors.

Additional Helps

Some additional circuitry can be incorporated to make your instrument more nearly a "hands-off" machine. That is, you can avoid having to clear and enter a digit into the display by doing it electronically when you actuate the RESET/READ switch. This refinement is shown in Fig. 2 and calls for a DPDT switch in place of the SPDT switch shown in Fig. 1. The extra pole is used to send a brief pulse to the CLEAR key when you RESET and another such pulse to the 1 key when you READ. The capacitors in the transistor base legs can be ceramic for compactness, but they and the resistors in series may require a little cut-and-try for best performance. The parallel resistors across the caps can be 10-22 megohms. The series resistors need to be around .5 megohms to 1.5 megohms, depending on your particular capacitor and transistor combinations.

The object is to inject a pulse of just sufficient duration to clear the display and enter 1 at any operating voltage without fail. If the pulse is too long, the key will hang up excessively and, especially, the 1 key pulse will subtract counting time from the ADD key function and cause a low readout on your unknown resistance. Too short a pulse will be more obvious; the display will fail to clear and/or will not inject a 1 for the module to count from.

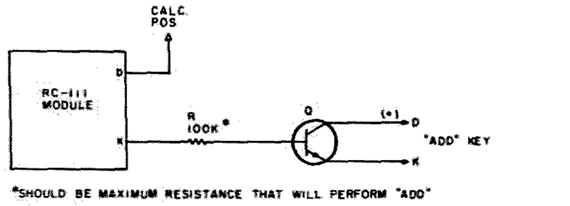


Fig. 3. Circuit for boosting module output for certain calculators (as needed).

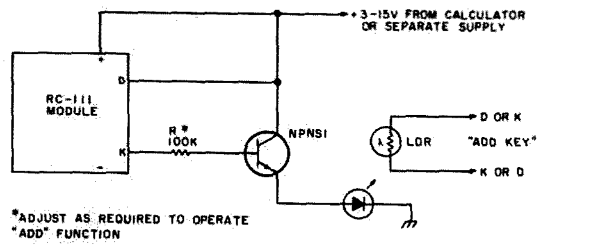


Fig. 4. Optically coupling module circuit to calculator.

Since the symptoms of erroneous choices are self-evident, it isn't too hard to land on the right combination. The series resistances should be on the high side to avoid ghosts in the display and excessive voltage on the transistor bases. The transistors can be just about any cheap silicon general-purpose units, the smaller the better. Once you have this circuit improvement squared away, the RESET/READ switch should do everything for you and prevent wear and tear on the fingertips.

Experimental Section

Other brands of calculators can be made to yield to this circuit scheme, but you may find that they have slightly different or perhaps more recalcitrant characteristics. Some appear to require a heavier current to actuate the keys, as evidenced by requiring a lower jumper resistor to do the job from the circuit side of the box. A boosted output for the module can be provided by a transistor in such a case, as shown in Fig. 3. In this case, the module D lead should be tied to the positive supply rail.

In calculators which have the necessary constant-add function performed by a third key (requiring, say, a CLEAR—1—ADD sequence followed by repeats on an EQUALS key, for instance), you still have the option of either entering the three initial keys and letting the module drive the EQUALS key or using the DPDT switch arrangement on the 1 and ADD, but leaving your finger to do the clearing. Again, the low-resistance keying problem might be present, which generally would result in three transistors being used for this arrangement.

Finally, if you have been intrigued by all the talk about opto-couplers, this project might be a useful place to start playing. Going back to the simple case of the module actuating the ADD key, you can produce this more exotically by shunting the key leads with a suitable light-dependent

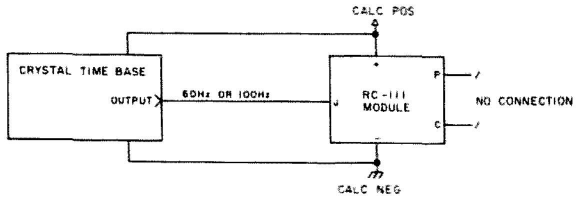


Fig. 5. Use of crystal timebase for high-precision ohmmeter and timer/stopwatch functions.

resistor (LDR) facing an LED operated by a transistor-boosted output from the RC-111 module as shown in Fig. 4. This scheme gives you a lot of potential design freedom, because the only necessary connection between the module circuit and the calculator can be a light beam. Consequently, if the gods and what-not are in your favor, you can operate the module on one battery (by itself, it only consumes a couple of milliamps, and only while counting) while the calculator operates on its own original supply, which can then include those situations beyond the 3-15-volt requirements of the module.

There are two precautions. First, the LDR has to act with reasonable speed in crossing from low resistance (to actuate the key) while illuminated by the LED to high resistance (for about an equal time) to let go of the key. Second, the LED has to be able to light the LDR sufficiently to effect the necessary low resistance, which means that it may require a pretty good-sized jolt of current to do the job. So, a satisfactory functional matching of LDR and LED is necessary and requires a little horsing around to get things just right.

Some LDRs are rather slow, and this might mean sacrificing some counting speed to incorporate this design. On the other hand, you may hit fat city and find that, for example, a fast and cheap photo-diode or photo-Darlington transistor will work just fine in your situation. Then you're home free. But you see why I entitled this part as an experimental section. As a hobbyist, you should be allowed to feel intrepid. On the other hand, I am obliged to state the disclaimers. I have to disclaim any responsibility for what you may do on your own hook. Fortunately, I have found so far that most calculators are very forgiving about all the rooting around in their guts.

Some Freebies

A number of non-ohmmeter possibilities may have become apparent by the time you have read this far. Yes, the module/calculator combo makes a pretty dandy and simple counter or timer or stopwatch, with or without the ohmmeter function. The timing will continue *ad nauseum* as long as module lead S is tied or switched to the positive supply rail and stop when it is on the negative rail. A second timing pot could be switched in to produce a timing speed more attuned to your needs.

Almost any calculator candidate should run fast enough to count by seconds; most will count by tenths, and some will make it to .01-second-per-count or beyond. For your own needs you might want to consider hundredths of minutes or even milli-hours or the like. Astronomers might even want to shoot for microsidereal-day time, in an extreme case. Although not crystal controlled, the precision is not bad with reasonable voltage regulation and can be set with an oscilloscope against multiples or submultiples of the 60-Hz line. For the calculator chips that can reach to 60 Hz or 100 Hz, one of the cute little boards that provides such with crystal control can be purchased for around $5.00 and run from most calculator power supplies. The output can be tied to the module as shown in Fig. 5, connected to the J lead while the P and C leads are left open.

Once you can measure Ohms digitally, you also can measure the ohmic relationships of other devices, of course. Therefore, this means that you can establish a relationship with light and temperature, to cite the most obvious examples. The aforementioned LDRs can be used to measure light, and at extremely low levels. So can a whole raft of other devices: photo-diodes, photo-transistors, and even plain LEDs. In these cases, the lower the light level, the higher the reading displayed, and if you have a big range capacitor, it might take minutes for the display to stop running if it is dutifully trying to count all the hundreds of megohms an LDR can reach at low light levels.

For this application I have found that a tiny 220-picofarad range capacitor worked about right for modest but useful counts when making enlargements in my darkroom. Because of the inverse light/count relationship, this combination is more properly a dark-meter, but that's beside the point. In effect, it reads out a number proportional to the right exposure . . . that's the bottom line in the photographic application. The LDR could optionally be connected to replace the timing pot (Rt) with a fixed combination of Cr and Rx chosen to time for a few seconds. In such a case you would get a reading that increased as the light intensity increased; however, in too-bright light, the calculator chip counting rate would be exceeded and the display would show funny results. With the LDR as Rx in the ohmmeter circuit, the excessive light intensity would register only your originally-entered 1 and would create less confusion.

A precaution about LDRs: As well as being a little slow, they have varying degrees of memory, so they don't immediately settle down on the first reading after a shift in light level. The fastest ones get there well enough to be extremely useful, but you would detect the discrepancy on a succession of readings. Thermistors are decidedly non-linear, and it takes some extra fooling around with the circuitry to get them to put out real temperature readings over a useful span. Ideally, you would fortify yourself with a calibration curve, or "normalize" the application.

If, for instance, you want to display a single photo-developer temperature digitally, and always use that temperature, the thermistor/range capacitor combination could be made to display "100" at the chosen temperature, from which you could empirically set acceptable limits from this value to suit the precision requirements for your needs.

Hams develop other situations for themselves in which a digital display of the results could be useful. An azimuth readout could be provided for an antenna, for example, by tying a suitable pot to the rotating antenna shaft as the Rx generator and scaling the display relationship to read out the number of degrees

representing the direction. Or, with a linear pot as the unknown, you could make a digital micrometer of sorts. The mind boggles at the prospects.

Perhaps the most immediately useful takeoff on the ohmmeter is the alternative of making the range capacitor the unknown and scaling with resistors in the Rx position to provide a few decades of readability. A megohm or two will give a display in microfarads to two decimal places. A commensurately longer string of resistors can enable you to reach to 100-picofarads-per-count and read microfarads on the same scale to too many decimal places to be of practical interest—and taking that much more time to count, as well.

The switching requirements to make a combined ohmmeter/capacimeter are not horrendous, but to do a really good job, you would want to consider a bigger case to accommodate range switching. If you have a dead-keyboard calculator to start with, perhaps try putting in a huge LED display in place of the usual small one. With commercial capacimeters selling for about ten times the cost of the Kaltek module, you can do almost as much (except for the teeny capacitances) and have the advantages of the digital ohmmeter in the bargain.

Conclusion

I could go on and on until the applications for the RC-111 module were limited by my imagination. But it seems fitting to leave off as above and tell you that the applications are limited by your imagination. In any event, this little device has a truly impressive cost-benefit ratio, and I'm confident that you'll flip over it.■

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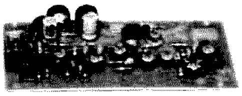

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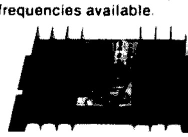

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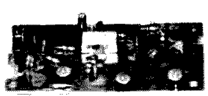

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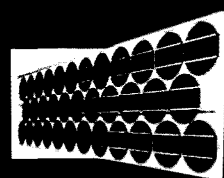

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Scanning with the IC-280

How many times have you seen a nifty circuit that would expand the capability of your operation only to be stopped cold by the thought of drilling holes or otherwise performing cosmetic surgery on your shiny new rig just to mount controls for the additional function? Here is a scanner that uses existing switches, costs about $25 maximum, and mounts inside the control head.

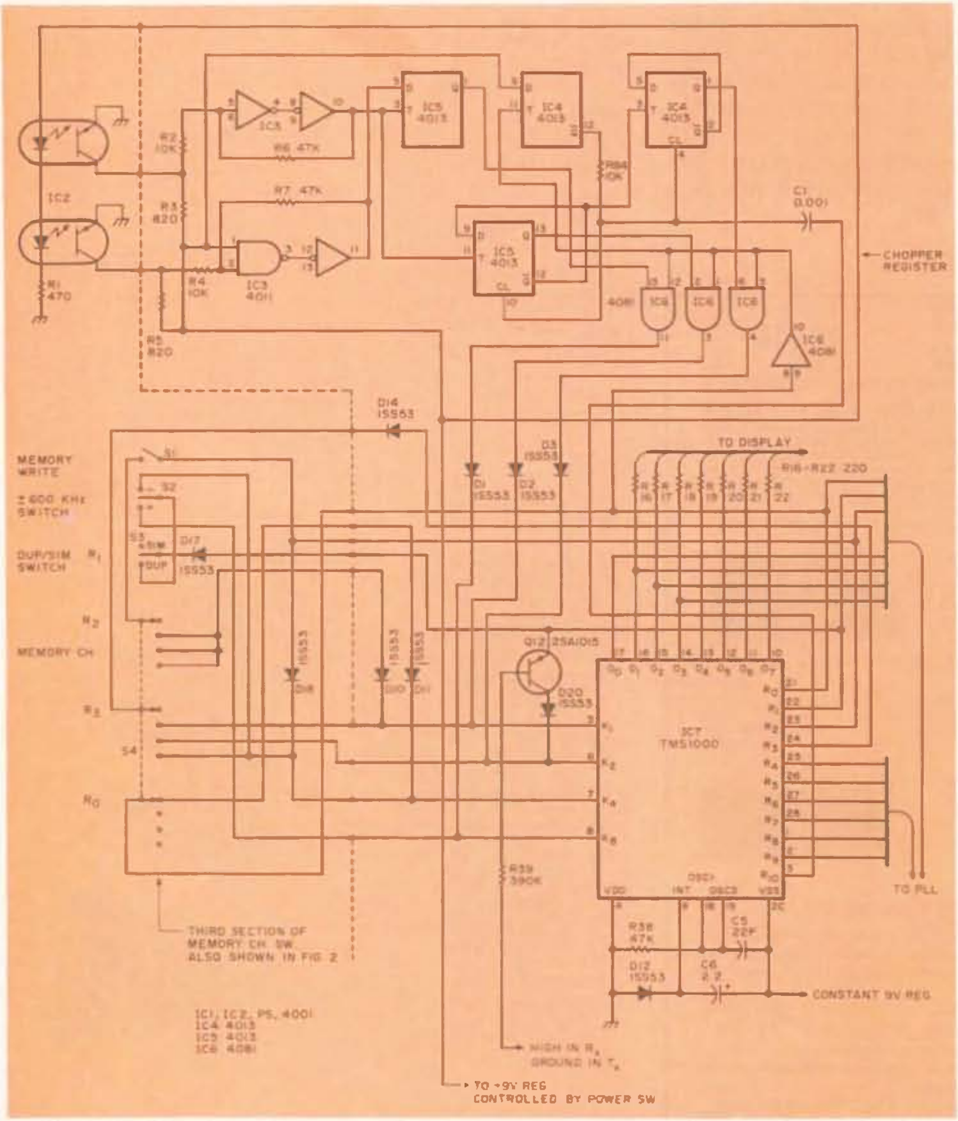


Fig. 1. IC-280 schematic diagram showing microprocessor and control input circuitry.

Two-meter transceivers as a class have been trending towards the low current drain of CMOS control circuitry, notably synthesizers and attendant display circuits with external control capability. The earliest example of this type of transceiver in the Icom line was the IC-22S which, for the first time, offered hams the ability to interface their rigs with a wide variety of hardware. Since then, several advances have been made, the latest of which incorporates a microprocessor into the control function.

Before proceeding further, one point should be emphasized. The microprocessor in the IC-280's control head resembles less a hobbyist's computer system (8080, 6800, Z80, etc.) and more the type found in a calculator. The chip is from Texas Instruments' TMS 1000 series of microprocessors which have all RAM and ROM in the same package and cannot access external memory of any kind. The ROM is mask-programmed at the factory and cannot be changed.

Nevertheless, it offers enormous flexibility (from the designer's point of view) in that it can be tailored for any type of control function in any type of system that can be imagined.

Flexible for the engineer but pretty well set for the user, right? Well, not quite.

The secret of enhancing the control capability of such a system lies in the realization that while the microprocessor is programmed for a limited number of control functions, these same functions need not be accessed via mechanical switches but electronically instead, upon command of other signals within the transceiver. In short, it is very easy to cause the radio to tell itself what to do.

Strobe/Function	Data Input Lines K1	K2	K4	K8
When dial is selected and RO is positive	N/C	N/C	High	N/C
R1 is the sim/dup strobe. When it is high and the dup. function switches are set, the following occurs	N/C	High if dup and in Tx	High if −600 kHz	High if +600 kHz
With memory-write switch depressed and R2 high	High	N/C	High regardless of memory write	N/C
If R3 is high and the memory-channel switch is set as follows:	High if Ch. 1	High if Ch. 2	High if Ch. 3	N/C

Table 1. Input data codes for microprocessor IC-7 in the IC-280 control head.

Theory of Operation

To understand how the scanner works, it is necessary to describe how data gets entered into the microprocessor.

The type of input used is called a scanning matrix. Basically, this means that there are just four lines (K_1, K_2, K_4, K_8) where information will go into the chip. However, due to internal circuits, the data input lines accept only certain types of information at certain times. These times coincide with a high R strobe, only one of which is positive at any given time.

For instance, of the four strobe lines we are interested in (R_0-R_3) for data input, we will assume that the R_0 strobe has just gone high, or positive. Strobes R_1-R_3 then are at a low, or ground potential. For the period of time that R_0 is high, the data lines K_1, K_2, K_4, and K_8 are interested only in data from the optical chopper register. This data will cause the frequency to increase, decrease, or remain unchanged and is updated at the strobe rate of about 125 pps (pulses per second).

Referring to the IC-280 control-head schematic in Fig. 1, it can be seen that the data lines are physically connected to a variety of switches and circuits. The reason that data from the chopper register is not garbled by these other components is that the common contact of each switch is connected to the strobe appropriate to its function. When the R_0 line is high and all other strobes are low, each low strobe is prevented from sinking current or pulling down voltage on the lines by means of a blocking diode.

When the R_1 line goes high, only data corresponding to that strobe is generated. Next, the R_1 strobe goes low and R_2 goes high, and so on. The function of each line in the matrix is listed in Table 1.

The scanner-module schematic is shown in Fig. 2. The switch section at the bottom of the diagram is the last section of the channel-select switch (see Fig. 1). The common contact normally connected to the R_0 strobe is now connected to the power switch through a resistor, R29. This allows the use of the switch section to select the dial mode in either the D or CH 3 positions by using analog switch S1 to perform the previous function of the channel switch. Thus, when the D position is selected, the transceiver operates normally.

However, with suitable modifications to the other two sections of the channel switch in the CH 3 position, the voltage now available from the last section in the CH 3 position is used to turn on analog switch S2 in the scanner, allowing pulses to pass through it. Analog switch S3 is normally turned on in the receive mode and will allow pulses from analog switch S2 to go to the chopper circuit. S3 is turned off in transmit, preventing scanning.

In the scanning position, a positive voltage is connected to pin 4, IC5 in the control head, which is the RESET input for the up/down flip-flop in the optical chopper circuit. Since the voltage causes the Q output to be forced low, the microprocessor always counts down.

To make the scanner count up, the SET line must receive the positive voltage while the RESET line is grounded. However, the scanner's performance is the same in either mode and it is easier to wire the IC to count down.

When the 280 receives a signal, a dc voltage imposed on the audio line is transmitted from the squelch circuit to the base of Q11, causing its collector to be grounded. The receive LED whose cathode is connected to the collector of Q11 is then lit. The collector of Q11 is also connected to terminal 11 of the scanner which in turn is connected to pin 12 of IC3, the input on a NAND gate. If pin 13, the other input to the NAND gate, is high, then the output on pin 11 will go to ground. A negative spike is then generated by C_4 and R_7 and is used to trip the monostable multivibrator which consists of two NOR gates from IC1 and C5 and R8, whose time constant will roughly determine the length of pause on an occupied channel. The values shown will yield about 9 seconds. R8 can be decreased to 50k Ohms to generate shorter pause times.

When the monostable is tripped, pin 10 of IC1 goes to ground, which pulls down the control line of analog switch S2 through D4. This action stops the pulses going to the chopper circuit, and the transceiver will stay on the channel until the one-shot resets.

The monostable circuit will not respond to further trip pulses on its input after the original spike so that the practical result is for the scanner to stop for a fixed length of time on an occupied channel no matter how many times the squelch is broken.

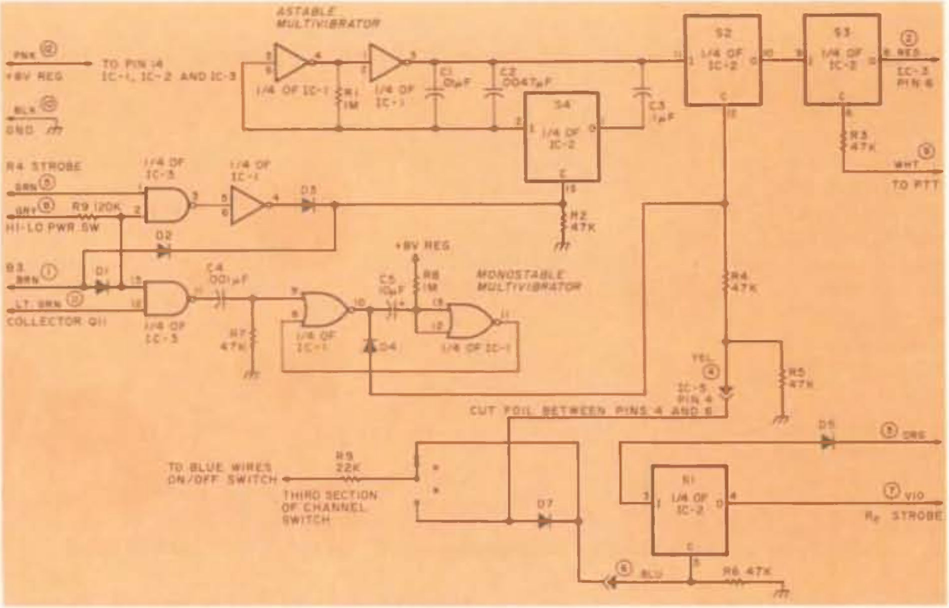
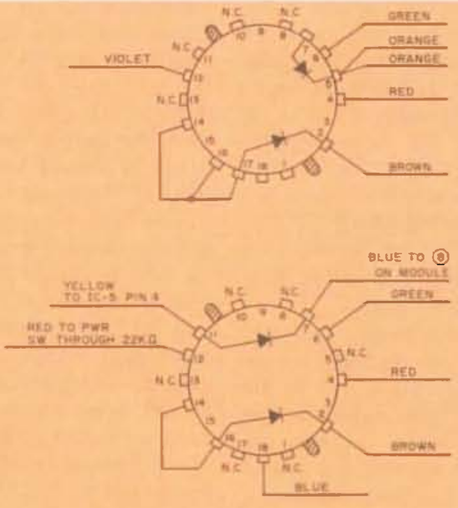


Fig. 2. Scanner module schematic.



1-4	No change.
5	Remove cathode of diode. Remove 2 orange wires and splice with orange wire from module. Leave this tab unconnected.
6	No change.
7	Remove anode of diode (its cathode was removed from tab 5). Install cathode of new diode and blue wire from module.
8-10	No change.
11	Connect the yellow 6" wire (not from the module) and anode of the diode whose cathode was connected to tab #7.
12	Remove violet wire and splice to violet wire from module. Install the 3" red wire (goes to power switch through 22k).
13-15	No change.
16	Remove anode of diode connected to tab 17 and connect it to this tab. This will leave tab 17 unconnected.
17	See tab 16.
18	No change.

Fig. 3. Channel switch pictorial and modification instructions (rear view).

The astable multivibrator, whose output is fed to analog switch S2, has two speeds selected by analog switch S4. When S4 is on, more capacitance is connected in parallel with C2 and C3, lengthening the time constant and lowering the output repetition rate. When S4 is off, the repetition rate increases.

The reason for the two pulse rates is that in the 146-148-MHz portion of the band, the set tunes in 15-kHz steps, and the 143-145.99-MHz portion tunes in 5-kHz increments. To keep the time spent in the lower portion of the band more or less equal to that spent in the upper portion, the scan rate must increase. The fastest scan rate is used if one is not interested in the lower portion of the band, a more moderate speed is used to detect occupied frequencies below 146 MHz, and 146-148 MHz are always scanned at the same rate.

If one wishes to receive signals in the 143-145.99-MHz range, two contradictory problems are apparent. First, if the scan rate is too fast, the scanner will not reliably stop on frequency—if it stops at all. If the rate is slow enough to stop reliably, the unit will spend a much greater period of time in a portion of the band which is relatively unused. The solution is to connect NAND gates, one of which is used as an inverter, to terminals 5 and 8 of the scanner and turn analog switch S4 on or off, depending on the state of the inputs.

Terminal 5 of the module is connected to the R4 line which is low when the kHz digit is 5 and high when the digit is 0. If the Hi/Lo power button is pushed in, terminal 8 is high. This means that analog switch S4 will be off when the kHz digit is 5 and the astable will have a high repetition rate. When the kHz digit is 0, the astable will take a longer time to change state. Therefore, a minimum time is spent on frequencies ending in 5 kHz and a maximum time on all others when below 146 MHz.

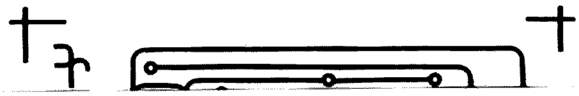
If terminal 8 is grounded (Hi/Lo button out), the scanner will be in the high-scan rate all the time unless terminal 1 goes high and turns on analog switch S4 through D2, slowing the scan rate. Terminal 1 is connected to the B_1 line (R_1 line from IC7) which goes high from 146 MHz to 148.11 MHz. The connection between pins 2 and 13 of IC3 on the module ensures that if terminal 8 is grounded, squelch breaks will not stop the scanner below 146 MHz, but will pause appropriately above 146 MHz.

Construction

Construction of the single-sided PC board is rather straightforward, and the foil layout is shown in Fig. 4. Wire color is specified in the schematic in Fig. 2, and component layout in Fig. 5. Tolerances are not critical; however, the components specified in the parts list fit the PC board. Since the

module is installed component side down, hookup wires should come out on the component side of the

and be careful not to strip the heads of the screws, which are generally quite



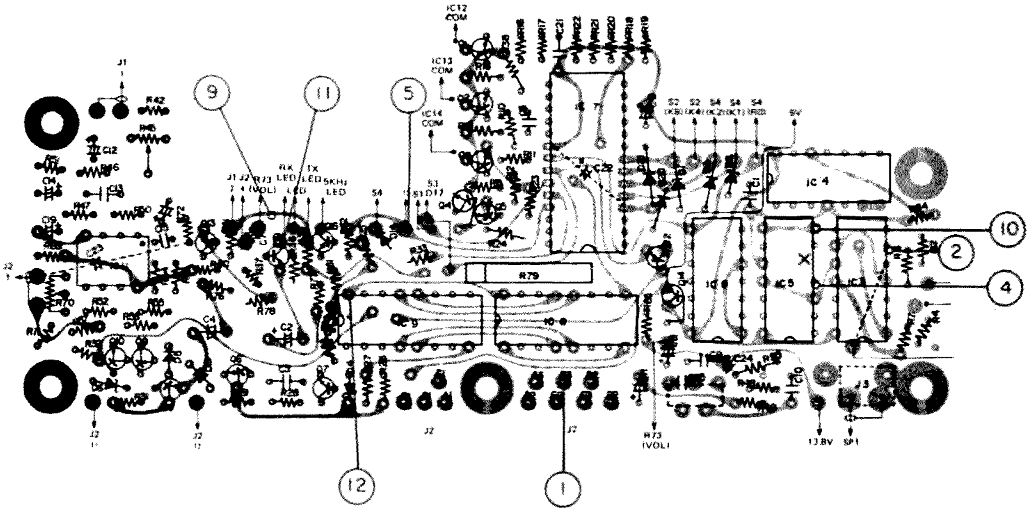


Fig. 6. Microprocessor and control board modifications location.

the leads of the CMOS IC in the head and also the tab on the memory-channel switch which has the yellow wire connected—it may be shorting to the metal frame.

To activate the scanner, select position 3 on the memory-channel switch. Do not be alarmed if nothing happens at first, but after about 10 seconds the digits will start counting down.

If the Hi/Lo power button is OUT, the scanner will pause again after changing from 146.00 MHz to 145.995 MHz whether or not a signal is received. After the pause, it should start counting rapidly downward until reaching 148.11 MHz, where it will count at a much slower rate.

When the Hi/Lo button is OUT and the displayed frequency is below 146.00 MHz and after the initial pause, a squelch break will not stop the scanner.

When the Hi/Lo button is IN, a squelch break (accompanied by the lighting of the Receive LED) should stop the scanner both above and below the 146.00-MHz boundary.

If these conditions cannot be obtained, check the input gate to the monostable on the module and also see if the cathode of scanner should always stop, thus preventing unwanted interference to others.

If a signal generator is available, hook it up to the antenna connector of the 280 and check to see that the scanner will stop on the right frequency. This check can also be performed using off-the-air signals if their frequency is known. If the scanner stops too late, increase the value of C3 by .001 uF to .005 uF.

Here are some ways the scanner may be used.

If the scanner pauses on a frequency of immediate interest, select position D on the memory-channel switch. This will be the same frequency as in the scanner position. Be sure to select the proper mode of duplex or simplex before transmitting.

If the scanner pauses on a frequency of less immediate interest, select either position 1 or 2 on the memory-channel switch and press the memory button to store the frequency. Select position 3 to resume scanning.

If a signal is received above 146.000 MHz and is not on the 15/30 kHz band plan, the scanner will pause will be quite readable. However, before transmitting the transceiver-tuning increments should be changed to 5-kHz steps according to the supplemental operator's sheet enclosed with the IC-280 in order to obtain the correct operating frequency.

Summary

With a few hours time and $10 to $25 invested, depending on where the parts are obtained, a reliable and simple-to-operate scanner can be added to the IC-280 without drilling holes or otherwise destroying the front panel. To date, seven scanners have been built using the above data and have been working with no problems.

For those who elect not to make the PC board, an assembled and tested module may be obtained by sending me a check or money order for $25. Etched and drilled PC boards only are available for $15.

Brief technical questions on the scanner can be answered only if you send me an SASE.

I would like to acknowledge the invaluable assistance given me by Allen

Parts List

C1	.01-uF, 12-volt ceramic disc
C2	.0047-uF, 12-volt ceramic disc
C3	.1-uF, 12-volt ceramic disc
C4	1-uF, 16-volt electrolytic PC mount (aluminum or tantalum)
C5	10-uF, 16-volt electrolytic PC mount (aluminum or tantalum)
D1-D7	1N4148 or equivalent silicon
IC1	4001 CMOS quad, NOR
IC2	4016 CMOS quad, analog switch
IC3	4011 CMOS quad, NAND
R1	1.3M, 1/4-Watt carbon film
R2-R7	47k, 1/4-Watt carbon film
R8	1M, 1/4-Watt carbon film
R9	120k, 1/4-Watt carbon film
R10	22k, 1/4-Watt carbon film

Misc.—PC board, solder

12 ea. 26- or 28-gauge stranded, plastic covered wire in 5" lengths in 12 primary colors and pastels in pink and in light green

1—26- or 28-gauge stranded plastic covered wire 6" in length, yellow

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

what to do about it, and lodging official complaints is not the answer. We've been that route for years.

The best solution to a nagging problem like this is to attack. Let's get organized and see what we can do to drive the dreaded dragon off our ham bands. If we work together, we can do it. And, yes, I'm suggesting some deliberate interference. Sauce for the goose.

Despite a lot of science fiction baloney about the woodpecker signals being used for behavior modification, all it is is long-range radar. The only behavior modified is the DX operators who start climbing the walls.

Okay, it's radar. Those of you who have an inkling of how radar works know the answer to the problem already. It's simple. If you want to screw up a radar signal, all you have to do is send a return signal on its frequency which blocks out the echos. Hams, from the earliest woodpecker days, have been driving the monster off their bands by getting on the frequency and sending properly spaced dots back. The screen somewhere in Russia blanks out and the operators utter some Russian oaths and change the frequency to get rid of the interference.

Now, if you chaps would get together into some networks to spot and erase this blight, we could get Ivan off our ham bands for good. You need a keyer which can be adjusted to send back pulses in between the woodpecker ticks.

There are a number of these pests around Russia, so you may have your hands full for a while. With persistence, I think they will stay out of our bands and go elsewhere for their radar work.

Or you can look on the bright side of things as you gnash your teeth over the noise. There is a good deal of evidence that the very high power transmitters being used for this work are having an effect upon the people immediately in its path. Indeed, one of the major woodpecker transmitter sites is just across the border from Finland and the incidence of cancer in the nearby Finnish town is reported to be exceptionally high. At this distance, *all* we get *is* apoplexy.

THE DANNALS DEAL

To say that I'm disappointed in a bunch of readers is to understate the case. I've gotten a lot of flack for my strong support of Dannals for the new general manager of the League and I think this needs to be brought out into the open.

Now look here... I think that some loyalty to the president of the League is in order and I don't want any more of those letters telling me that good old Harry is a pompous fathead. Harry and his father before him have been ARRL directors. Could you ask for any more loyalty than that?

And if you're worried about your League getting into trouble, just remember that Harry is already retiring from his lifetime of work as a union steward, so a couple of years as general manager of the League isn't going to make a lot of difference. Isn't it about time that a loyal supporter like that had a chance to get a decent salary for a year or two... and an unlimited expense account? Not to mention a very generous retirement from the League in a few years. That retirement pay plus his first retirement pay should allow Harry to go on as many DXpeditions as he wants without any further worry about money. It's only a few bucks out of your pocket, so why be chintzy?

Remember that amateur radio is in the doldrums right now. It's not the worst doldrums we've had... those were back in 1964-69... but they're pretty dol. Thus it really isn't going to make a big difference what the ARRL does for a while, so why get exercised? I say give Harry his due and stop all the beefing.

It is hard to stop the rumor mill, but I really don't put any credence in the gossip that Harry will be moving HQ to New York so it will be closer to his home. Of course, that would be a bit closer to Washington, where it really should be... but not close enough. Yes, I know that they don't need that huge building any more and that it is a bear as far as heating goes. But remember that the building didn't cost the League much since it was paid for by member building fund donations. With the staff cutbacks, they could make do with a lot smaller HQ building, or perhaps Harry will rent part of the building out to economize.

So let's not hear any more of this heresy and bad-mouthing of Harry, okay? Some of the things he's done have given the impression that he doesn't have both oars in the water, but that may be because you don't have all of the facts. Take heart and remember that even if Harry turns out to be as inept as Baldwin has appeared, the League will still survive. Not to worry.

ARRL ATTACKED

Those few of us who are still reading *HR* were aghast at the February vicious attack against the ARRL in the editorial. What is the world coming to? This would never have happened under the guidance of good old Jim Fisk, who was able to stomach anything the ARRL did.

Ham Radio magazine, which has been dropping steadily in ad support, had some corking good articles in February... too bad if you missed them *and* the ARRL attack. For instance, there was a pip of an article on how to use the HP-34C computer to design Pi-L matching networks, something which I'm sure has plagued all of us. Those pages of charts will be of incalculable value to thousands of hams who prefer to design their own matching networks and put them in place of the factory-built circuits in our sideband rigs.

Another spell-binder was a 7½-page article on the systematic design of crystal ladder filters. I'll bet they thought I'd forgotten all that calculus I was crammed with 40 years ago in college... well, here's where I could finally get it out and use it. You can bet that hams will be quoting that article for several years to come.

With the thermometer outside my window hovering at −10°, I read with amusement their state-of-the-art rotator article... using a rope going through two holes in the house to the beam. The two rope holes would let out enough heat to pay for a rotator in one winter here.

Well, I'm sure we're all glad to see *HR* hanging in there... even after losing both *Ham Horizons* and *Ham Radio Report*.

BUILDING

One of the ways in which radio amateurs have been of value to the country down through the years has been in their designing and building of new equipment. It's been a while since I've polled the *73* readers to see what percentage are into building, but the last poll showed that 80% had built at least one home construction project during the previous year.

The high percentage of ads for parts in *73* indicates that you readers are still building today. I don't think there is any other magazine with more ads for parts. Building is one of the more fun things to do in our hobby, so I'd like to do all I can to encourage more of it.

You know, it doesn't take a lot of technical knowledge to get started building. Once you get into it, you find that you are learning every day. It's a great fun way to learn the technical end of things... learn by doing. Then, when you get on the air, you have something real to talk about. You can beef over the problems you had in getting something to work, knowing that the chap on the other end is eating his heart out that he doesn't have a similar story to swap because he has bought *everything* he is using.

To help get more hams into building, I'm asking that everyone who has designed and built something unique write it up and send in the article. It's your responsibility to encourage more hams to build, and only a wealth of interesting projects will do this. Writing the articles is up to you. I'll publish them.

When I started *73*, it was with the idea of promoting ham building. Down through the years, *73* has always been the builder's magazine. We have used the space *QST* wastes on those endless activity reports to publish articles and more articles, a good percentage of

them on small construction projects which can be done in a weekend. Now, with *HR* rapidly fading away, we'll be running a few more of the back-breaking type of construction projects for which they were justly famous. We don't want them to stop just because *HR* is fading away.

Hams are builders. The more construction projects you send in for us to publish, the more you'll get in *73*. I would like to see articles on all aspects...simple projects and engineering masterpieces. I'd like to see 'em on digital circuits, gadgets for the home, for the car, antennas, tuners, automatic identifiers, new slow-scan circuits, color slow scan, and so on. We are perhaps five hundred articles behind on what I would like to see in RTTY developments.

There are some small groups working on ever more exciting repeater networking systems. Let's see articles on these which will spur other groups to get into the game. Let's see articles on the networking circuits. I don't know if you know about it, but there are at least a couple of ham UHF networks which connect virtually all of the western part of the country together. You can use an HT in San Diego and talk to El Paso or up to Oregon, all without interrupting local repeater operations along the way.

No one has figured out how to get from the Rockies east with these nets so far. The short hops in the flatlands have temporarily stopped the spread of these systems. Perhaps we can have some ideas on that...and more construction projects.

You design it, build it, and write about it...and I'll publish it, getting thousands of hams to build your circuits.

GOOD ARRL NEWS!

Just when I begin to get discouraged over the slowness of the League to react to technology and other changes, something interesting comes along. In this case, there is a report in a well-known DX bulletin to the effect that some badly needed changes in DX contest rules have been made.

The piece reports that the ARRL contest advisory committee in a vote of 8 to 3 has decided to modify the operating periods of both the CW and the phone DX contests to allow two additional hours of operation for both the first and second district stations. They noted that during the last few years the East Coast has come very close to losing its dominance in this event and the committee felt that this rule change would ensure that the traditions of the past are preserved. Bravo!

Anyone with comments pro or con should contact *QST* about this. I think we should continue to look to the League to preserve past traditions and look to *73* to preserve traditions yet to come.

FAVORS

Most of us have read some of the reports from the FCC on the trial and conviction of one of their licensing people for selling ham licenses. A lot of hams got furious when they heard about that.

After talking with some of the people who were intimately involved, a rather different story from the official version is told. It appears that there has been a good deal of cover-up of actions by higher FCC people who seem to have started the whole mess.

I've read the official reports and got the impression that this chap Zigler had been selling ham licenses and got caught, and that there were just a few bad hams involved.

This is reported to have gotten started when Prose Walker, who was the chief of the ham division of the FCC, started asking Zigler to do some "favors" for friends of his—upgrading of licenses, special calls. Zigler apparently got fed up with this after a while and told some of his close ham friends about the situation and asked if *they* had any special cases who might need a favor, as long as he was doing favors. No money was involved with any of this. One chap I talked with swears he was in the room with Zigler when Walker called with a request for five more friends of his to get favors.

Things mushroomed, with the final count being 843 favors granted by Zigler. That's more than a few. Eventually the word got around and Zigler's friends began getting cash offers for upgrading of their tickets. Then, after a while, some of the friends were sending Zigler cash. It's tough to send back unaccounted-for cash.

Someone finally blew the whistle. Zigler was convicted and put in prison for a few days. The FCC came out of it fairly clean, and a few of the favor recipients lost their tickets. Just a few, not 843.

This is still grinding along through the courts on some level, so some day we may get the facts and be able to put all this into perspective. The people involved use the term "favors" rather than bribery. This seems more applicable in this case. I understand, too, that Zigler was quite upset by the pressures he was under to do these favors for Walker and I suspect that the favors for friends were more in retaliation for being forced to do what he considered wrong than as an enterprise in itself. All agree that Zigler was one of the nicest guys you could ever want to meet and that he was a victim, not a criminal.

Well, that's the story. I'm open for any further information, pro or con, as this develops.

Some of the victims of this disaster are asking what the real difference is between someone who has been upgraded as a favor and the chap who has spent one day with Bash in his high-pressure memorization course which teaches you all of the test answers word for word. The end result is about the same: a higher grade license with no knowledge necessary.

The real misery comes later when these people get on the air and can't let their fellow amateurs know that they don't know anything. That's when we start finding bad language and disruptive operating.

I can't in any way defend what these chaps claim Walker got started...or Zigler continuing it. But is it fair to crucify Zigler and let Bash keep going?

SMITH CHARTS

That's right, Dick Smith of Dick Smith Electronics in Australia is charting a trip around the world via helicopter. And, yes, of course he'll have a ham rig aboard, working 20-40-80 meters as he flies.

The trip, which is scheduled to start in August, 1982, will be a solo flight, with most hops in the 200-400-mile ranges. It will start from Dallas and run up the east coast, across to Greenland, Iceland, the Faroes, down across Europe, down by Jordan and Egypt, across Saudi Arabia, Pakistan, up to New Delhi and Katmandu, down to Calcutta and Rangoon, and on down Australia to Sydney...home. Then he'll head back up through eastern Asia across the Philippines, Japan, and across the northern Pacific via a couple of shipboard refueling stops to Adak in Alaska, down to Anchorage, Seattle, and to Dallas. He's expecting to end the trip in early 1983...the first solo helicopter flight around the world.

Working him as he is flying will be fun, but I do hope he will plan some time on the ground to get on the air and give us DX fanatics contacts with the 30 countries he will be visiting along the way.

As the trip draws near, we'll

Australia's Dick Smith VK2ZIP.

try to have a lot of information on it for you.

READER RESPONSES

There are some questions about *73* on the reader response cards and every so often we get reports from the firm which processes these for us. I think you may find some of the news interesting.

For instance, the latest replies, sampling about 5% of the readers, gives our readers an average income of $26,400 per year. Surprisingly, perhaps, 31% are making over $30,000 per year. Affluent group, really. That's up from 21% a year ago.

We asked how much you spent last year on ham gear and the average was $750. That's the average! When we apply that to the entire readership of *73*, we find that you are spending nearly $8,000,000 per *month* on ham equipment. Now that's just you *73* readers, mind you, not the average ham. Indeed, there is a good reason to believe that our group represents about 70% of the total buying of ham gear. That's higher that we expected.

Manufacturers looking for new products which will interest hams should note that 13.1% of the readers are actually active on RTTY today and 48.9% say they are not on RTTY, but are interested in getting on RTTY. That comes to around 60,000 *73* readers who have expressed an interest in RTTY. That's a gold mine if I ever saw one.

With the increased circulation of recent months, and going by the reported readers per copy of the magazine, over 125,000 hams are reading *73* every month. At $3.00 per copy, there is a lot of pass-along readership, but the pass-alongees are mostly active buying hams, not retired old-timers on pensions.

Speaking of gold mines, 80.5% of the readers want more articles on satellite television. I honestly expected to run into the usual resistance to new ideas with this and am pleased that everyone is hot to trot. You know, it is only a matter of time (and not much) before hams start getting much more into satellite communications. The time is just about here for that.

From 73 MAGAZINE

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WALKMAN TALKMAN

About three years ago, Sony came up with one of their usual brilliant ideas... the Walkman. This was a tiny audio cassette player which could be worn on the belt and used with a startlingly new type of lightweight stereo earphone system to make it possible to enjoy truly high-fidelity sound reproduction.

Having been a manufacturer in the hi-fi business back in its early days and thus knowing what is involved in such reproduction, seldom heard with home systems which are affordable, I was astounded when I first heard the Walkman player. It was great for walks and even for skiing. Of course, by the time I loaded up for skiing with the Walkman, some tapes, and an HT, my pockets were so full of expensive electronics that I didn't dare fall down.

As tiny as the first Walkman from Sony was, a couple years later they surpassed themselves with an even smaller player... almost the size of the cassettes, only a bit thicker. This came out at about the time that the market was being flooded with knock-offs of the original Walkman made in Hong Kong and Taiwan.

If you have never listened to the sound from a Walkman, you should take the opportunity the next time you see a friend with one.

Okay, now on to the Talkman... not by Sony, but being made by an old Japanese friend of two-meter hams... Standard. I ran into an ad for this unit in the latest JS&A catalog. Joe Sugarman, who, by the way, is a ham, has built up quite a reputation for state-of-the-art men's toys, so I wasn't surprised to find this new gadget appearing first in his catalog.

The Talkman is a 50-MHz transceiver which you wear on your belt and which comes with a headphone-microphone set. It is designed for use by two people who want to be able to talk despite local noise or moderate separation. The transmitter is voice actuated, so you don't have to flick any switches. The sound is excellent quality, and there are a minimum of controls and adjustments so that anyone can put it on and use it.

This is just what Sherry and I have been looking for to use in the Dodge van. It is so noisy in the van that normal conversation is almost impossible, even when she is in the front seat. As soon as she heads for the seats in the middle or the lounge in the back, we've always had to scream to be heard. The Talkman is perfect for this type of use.

The Talkman is also great for things like skiing lessons where you want to talk to someone without having to yell a hundred yards or so. Or for talking with someone on top of the tower making adjustments while you are in the shack tuning up. The chap on the top of the tower does not need to hold an HT in one hand and the tower with the other. We lose a lot of hams that way.

Have you ever gnashed your teeth in frustration while waiting for your wife to come to an arranged meeting spot in a shopping mall? With a portable typewriter I could have written an encyclopedia just in waiting time. Now, with the Talkman... I'm able to find out just which of the toy stores has grabbed her and is holding her for ransom. Grandchildren, you know.

They're a lot lighter and easier to use for short-range communications than HTs, even if both people wanting to talk have tickets. No license required for these low-powered 50-MHz sets ... and the antenna is built into the headphone wires, so you don't even poke out eyes.

Sherry, who is into ballooning (just went down for her instructor's ticket), will find the sets great for balloon-to-ground communications. It's very handy to let the ground crew know where you're planning to land. Sherry got hooked on balloons when we went down to Florida about five years ago for a two-meter balloon-to-balloon operation. Now she has her own.

I've often wondered why Standard didn't keep up with the US two-meter market. They were one of the first and foremost in the field here, but then got behind when the Icom synthesized rigs came out. I still see some great looking Standard ham gear in the Japanese magazines, but no sign of US models being made. I'm still getting good use from my old Standard HTs.

Vince Luciani K2VJ
PO Box 682
Cologne NJ 08213

Detect Killer Tornadoes

—use an ordinary TV set

Editor's Note: This article presents a controversial method for detecting tornadoes. *73 Magazine* urges you, the reader, to consider ALL practical methods of storm detection. We endorse no particular procedure but do encourage experimentation with the Weller Method and other promising ideas. We would like to hear from any group or individual who has automated the Weller Method or used it in conjunction with an amateur radio network. For more information, see *Tornado-Wise* by Vince Luciani. Available from Cologne Press, PO Box 682, Cologne NJ 08213. Soft cover, $3.95 plus $1.00 shipping and handling.

Grab the cat, Ma! Head for the cellar! The bloomin' TV set just went bright!

How many readers could apply a Sherlock Holmes analysis to those words and come up with the scenario of a tornado watch? A watch in which a family has been using the "Weller Method" of detecting killer tornadoes using a home TV set—and a funnel has just touched down!

Holmes would have had a problem in deciding whether the tornado detector was the cat or the TV set, although the modern detective would know it was the latter. Yet one day there may well be a study of the effect of tornado electrical radiation on cat's fur, for the subject, tornado electrical radiation, is quite controversial.

If you are among the few who have heard of the Weller Method, you may also be among those who remember what it is and—of much more importance to you, Ma, and the cat—how to use it properly.

Back in 1969, Newton Weller of West Des Moines, Iowa, had a garage packed with over 100 TV sets as he worked on his theory that the electrical radiation from killer tornadoes leaves a "signature" in the air for miles around, a signature that could be detected on an ordinary home TV set.

Technically speaking, the electrical radiation from tornadoes peaks very near to TV Channel 2, and Weller discovered that if you properly adjust your TV set's brightness control, the set could then respond to nothing but the tremendous electrical radiation from killer tornadoes. (A description of the Weller Method is given with this article. It should be read carefully before attempting to make use of the technique.)

When Weller had checked out every TV set marketed at the time (to make sure they would all respond properly as a tornado detector), he announced his discovery to the press via a Des Moines newspaper which printed the story a day before tornadoes struck the area. Weller's timing couldn't have been better, though Iowans claim that the probabilities of springtime tornado strikes are always uncomfortably high.

Iowans had a chance to check out Weller promptly, and some did exactly that. Several later wrote to thank him for his contribution to their welfare, explaining that their TV sets had, indeed, gone bright from tornado electrical radiation. This feature is the thrust of the Weller Method—that the electrical radiation from a killer tornado touching down will overcome a darkened screen and cause it to go as bright as a fluorescent bulb.

Closer to home, however, Weller commented, "My wife had all kinds of complaints about those TV sets in the garage, and if that strike hadn't happened when it did I might have given up on the whole idea."

Fortunately, he did not give up. Not that the weather service seems to care. The National Weather Service (NWS) has never cozied up to the notion of a mere TV set "broadcasting" tornado warnings on its own. Despite reports of successful results everywhere, Weller remains largely unrecognized for his work except in Tornado Alley.

NWS has conducted limited testing on tornado electrical radiation. One test, for example, was on a series

of strikes near the National Severe Storms Laboratory at Norman, Oklahoma. Those particular strikes apparently had reflected little electrical radiation—as happens with some—and based on those strikes, the report issued later disputed evidence of significant electrical radiation.

Apparently, several of the nation's leading meteorologists disagreed with the report, as was evidenced in counterpoints (somewhat biting) expressed to the NWS. There is, you see, quite a bit of controversy associated with tornadoes, and we really know very little about what causes them and what sustains them. More than cat's fur has been rubbed the wrong way in the argument over whether killer tornadoes pack significant electrical radiation.

While one side says there isn't any electrical radiation to tornadoes, the other side asks about those reports from people who have actually looked inside a tornado funnel and have lived to tell about it. Such reports have been of constant lightning, brilliantly-luminous clouds, "balls of fire," and rotating bands of deep, blue lights similar to those of an arc welder. And, they add, what about the reports of scorched vegetation along a funnel's path (later seen quite clearly from the air), and of the strong smell of ozone (so characteristic of strong electrical discharges)?

In a pig's eye, some have answered.

Pig's eye or cat's fur—the cat's got no one's tongue in the forever hanging controversy over tornado electrical radiation. The *subject* is quite electrifying, anyway, yet one seldom will read about this feature unless one subscribes to certain stuffy journals and is willing to wade through some weighty statements. Few contemporary writers who are meteorologically founded will broach the subject. Yet, the public has a need to know.

Readers should be able to choose for themselves. Perhaps, in a moment of off-season nonchalance, one may be inclined to stifle a yawn over a discussion of tornadoes, but if you are in the proper geographical area (as evidenced by having middle-range ZIP codes), and if it is getting on toward springtime, you are well advised to properly learn the Weller Method—its good points as well as bad.

And speaking of the bad side, it is, indeed, a fact that not all tornadoes pack the extent of electrical radiation that makes the TV screen go bright, which is why certain sides contend you've got holes in the bottom of your salt shaker if you even think the Weller Method is reliable.

"Of course it won't work with a weak tornado where the electrical energy is too low," says Weller. "But that weak tornado won't usually do much more than lift the roof off a hog shed—and even a straight windstorm will do that. The TV set *does* work on killer tornadoes, and they're the ones that count!"

Weller associate Paul J. Waite (Iowa State climatologist) has this to offer: "Until we have the perfect warning system, we should not neglect any opportunities to provide our populace with the means for self-protection from the ravaging destruction of tornadoes." Amen!

How close are we, these days, to perfection with NWS tornado detectors? Not very. Mostly, the NWS relies upon outdated vacuum-tube-type radars. Vacuum tubes, if you remember, were the gadgets that helped us advance our learning until we really took off with the discovery of transistors and solid-state circuitry. NWS definitely needs to replace those old radars.

Exactly, says the NWS, and they have proposed a $250 million network of modern Doppler-type radars, with a few of which they are currently experimenting. (Doppler, by the way, is a physical principle which involves motion detection; whatever else a tornado's funnel can be characterized as, it is certainly a dynamic picture of nature in motion!) But, a quarter-billion-dollar outlay in today's slash-everything economy? Not very likely.

Even so, Dopplers actually add very little improvement in the accuracy of tornado detection. They offer, instead, a significant increase in lead time once they do spot a for-real tornado. That *is* important. Lead time, as they like to say in Tornado Alley, carries a mite more concern in a tornado watch than does lead time on a rising covey of quail. Quite a mite more. It shouldn't surprise readers, then, to learn that the most effective tornado detector anywhere is the trained human eye. Which is exactly the talent NWS makes good use of via concerned citizens in an organization called "Skywarn." These are the civilian spotters throughout the country who offer their services

THE WELLER METHOD

1. Tune your TV set to Channel 13. Adjust its brightness control to make the screen nearly (though not entirely) dark.
2. Switch to Channel 2. Do not make any further adjustments to the set. The screen should still be nearly dark.
3. Sit and wait. If the screen suddenly flashes on brightly and stays lit, move fast! That's the indication that a killer tornado funnel is down anywhere within 5 to 15 miles of you—perhaps, quite near.

Notes

- Be careful, in Step 1, not to set the brightness control too low, or the set may be so desensitized as to not respond even to the tornado's tremendous electrical radiation. (For simplified understanding, consider tornado electrical radiation as being equivalent to a radio transmitter broadcasting on Channel 2; the analogy is reasonably accurate.)
- Some color sets cannot be made to respond to the brightness control adjustment. Be sure to check your set for this capability.
- If your color set does not turn down with the brightness control, your best bet (always) would be to use a portable black and white TV set for the Weller Method. The added advantage of being battery operated makes it useful when power lines inevitably go down in a tornado strike.
- If you are on a cable TV system, disconnect the cable from in back of the set and connect the built-in antenna.
- A local station on your Channel 2 may, during a tornado warning, cause the darkened screen to switch back and forth a few times from being brightly lit by the tornado to the local TV program. As the tornado approaches, its tremendous radiation will take over and cause the screen to stay bright.
- *Not all tornadoes pack intense electrical radiation.* Continue, therefore, to monitor news broadcasts either on a second TV set or by radio.
- Practice the Weller Method when lightning fills the air. Note how lightning affects your darkened screen, and become familiar with how dark to make the set. You will then be more sure of yourself when the time comes that your screen stays brightly lit.
- Be prepared ahead of time—you and your family—on what to do if the screen goes bright. Know your plan well enough to avoid panic reaction. Know what safety measures to take, and know them well in advance.

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(often, quite courageously) for your benefit and mine.

People from all walks of life have taken up the public service banner in support of Skywarn, though perhaps no group has done so more completely, more effectively, than that special class of citizens known to us as amateur (ham) radio operators.

In Texas, for example, nearly 2,000 ham radio operators are on call to assist NWS when storm alerts are sounded. Most members take annual courses in tornado spotting, not only to improve their effectiveness but also to learn when to zig rather than zag as they are driving out there in the thick of things, spotting a downed twister as it snakes its deadly way across the plains.

Lone Star members of the hobby proved their worth at Wichita Falls, Texas, in 1979, when a series of killer tornadoes caused a half billion dollars damage. NWS credits the early-warning communications networks of radio amateurs with having saved 1,000 to 2,000 lives there. Such is the dedicated public-service nature of a hobby which includes ditch diggers, executives, and even a US senator!

Through it all, and continuing to survive the test of time (which is an admirable bottom-line characteristic to any theory) is the continuing undercurrent of support for the Weller Method. This is from an informed public, those who like the idea of having a detector for killer tornadoes right there in the house.

Not that the Weller Method works on every funnel that comes puffing and blowing down the field, but when the TV set does go bright . . . *"Grab the cat, Ma! Head for the cellar!"*■

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TVRO Dish Selection Tactics

—Satellite Central, part V

Picking the right antenna for your TVRO can be dangerous! Too many people are ready to tell you that theirs is the best. Who can be trusted?

For example, we know the press release blitz touting the 3-foot dish for sparklie-free pictures was just a wild fantasy. All the hoopla was directed at the 12-GHz direct broadcast satellite (DBS), but somehow developed into identical claims for 4 GHz! The mere difference in frequency suggests that this isn't possible at 4 GHz. So you must arm yourself against those that would have you believe that the TVRO antenna department runs on magic!

At the moment, the biggest selling point is gain. But the three things you really should be looking for in a dish are *size, accuracy,* and *feed match.* Despite what sales claims may say, they all carry about equal weight!

Formula Blasts Wild Claims

Here's an easy way to rip away the veil of mystery concerning dish antenna gain versus size. Simply use this formula the next time you see a demonstration or see an ad touting high antenna gain. Just plug in the numbers to find the true gain.

$$\text{Gain in dB} = 10_{\log}(F^2 \times E \times D^2),$$

where F is the frequency in GHz (3.7), E is the efficiency in percent, and D is the diameter in meters. You can convert feet to meters by simply dividing feet by 3.28.

The trick to using the formula is knowing the efficiency of the antenna. While a quality dish may have 55 to 60 percent efficiency, the typical value for home-brew may only be 50 percent owing to poor surface integrity and feed design, as we shall soon see.

As a practical matter, you could stuff the formula into a programmable calculator and take it with you when you go dish shopping. Or you can type the dish gain program seen in Fig. 1 into a pocket computer such as the Sharp or TRS-80. It's only a few lines of code and may very well be worth the effort, especially when a salesman touts his 10-foot dish as having a whopping 43 dB gain! You can simply dig into your pocket and produce a better approximation of the true gain.

I saw an ad in another

The antenna wizard and his sacred tools of alchemy.

```
10 PAUSE "PARABOLIC DISH GAIN" : BEEP 1
20 INPUT "DIAMETER (FEET)"; D
30 INPUT "EFFICIENCY % (55)"; E
40 INPUT "FREQUENCY GHZ (3.7)"; F
50 D = D/3.2808 : G = 10*(LOG(E*(F*F)*(D*D)))
60 PRINT "GAIN = "; G
70 GOTO 10
```

Fig. 1. Calculate true dish antenna gain with this simple program for the Sharp or TRS-80 pocket computer. The program will run on almost any other computer supporting BASIC. What self-respecting computer doesn't nowadays? Only line 10 may need adjustment. The strange values in parentheses in lines 30 and 40 are suggested inputs.

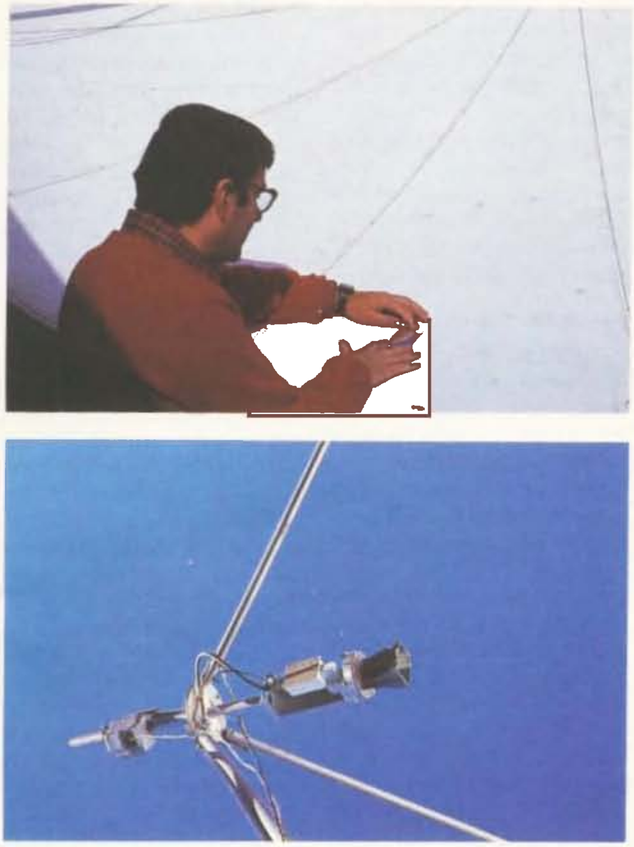

Fig. 2. Doing it with mirrors may tell you the whole story about dish accuracy. Use a small mirror and point the dish at the sun. The reflected rays should bounce into the feedhorn.

Fig. 3. A long pole or length of wall molding will reach anywhere on a dish and is safer. Tape the mirror to the pole like a hinge so it rests flat on the dish. Very few inexpensive dishes will pass this test. When you find one that does, buy it!

magazine recently that indeed claimed 43-dB gain from a 10-foot dish. This was beyond belief! In fact, I immediately tried to buy one because at 4 GHz, a 10-foot dish would have 100% efficiency and I wanted to be the first to own this eighth wonder of the world! But an excited call to their chief engineer revealed that he not only assumed 100% efficiency, but used a feedhorn known to achieve just 55% efficiency at best for this dish size and depth. He even did all his calculations at the high end of the band, which he was " told to do by the sales manager."

This is another trick you might want to watch out for. If gain is computed only at the high end of the band (4.2 GHz), you can make the numbers look nearly 1 dB hotter. Try it yourself. It's like adding nearly 2 feet to the dish diameter! This clever ruse can give the buyer or home builder a mistaken impression of the gain being the same at the low end of the band (3.7 GHz), which it isn't! After all, we do want to receive the entire band, don't we? You may think this an arbitrary point, which indeed it might be until you remember that just one single decibel in an FM system like this one can make the difference between a clear picture and a snowstorm. Many manufacturers today are calculating gain this way and you should know about it. *Caveat emptor!*

It's Not How Small You Make It

While it's possible to just get by threshold with only an 8-foot dish using a very low noise amplifier on a hot footprint, you will be better off using a 12-foot or larger dish for really sparklie-free pictures almost anywhere else. Even larger dishes may be necessary as you move off the footprint. Perhaps you recall from our past discussions that the LNA and dish operate on a kind of teeter-totter where a large dish can allow a cheap LNA to be used. Likewise, similar results are possible using a smaller dish and a higher grade LNA.

How small can you go? Eight feet is about the low end for wideband FM video due to the fact that the beamwidth and side-lobe response of smaller dishes let more ambient terrestrial noise reach the feed. Side-lobe response is very important with a TVRO antenna because the signal is about 30 dB or more *below* the noise.

It appears there's more to a TVRO antenna than just collecting a signal. It must also be a kind of rejector as well, a shield to the barrage of interference in the vicinity. It might be easier if the noise were man-made, but the music of the spheres is an annoying din, especially from our own particular sphere, *terra firma*, which demands we use ideas bordering on geometric optics to build workable antennas. As better and smaller antennas are designed, lower noise amplifiers will take up the slack in lost gain due to improved antenna shielding properties. But more work on this problem is needed. The horn/reflector is a very

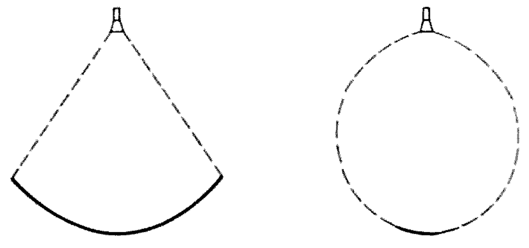

Fig. 4. Typical feedhorns fall off in sensitivity near the edge of the dish. Circular models may capture as much as 1 dB more signal. 1 dB is nothing to sneer at. It's like switching a 120-degree LNA for a more expensive 80-degree model!

good solution despite the plain fact that its large size makes it impractical at the moment.

How To Check Dish Accuracy

A really good dish will follow a parabolic curve to within plus or minus 1/16th of an inch. Achieving this accuracy is no easy feat. Some manufacturers will rightly say that such accuracy won't improve the gain, which is true to some extent. But the argument falls down flatter than a bad dish when side lobes are considered. Side-lobe response is directly related to surface accuracy.

Why are side lobes important? Remember, we are trying to hear a soft conversation in a room full of shouting people. The ambient noise floor at the antenna site may be −130 dBW, but the signal we want is a lowly −160 dBW . . . or worse. Only a narrow beamwidth dish with very low side lobes will receive it while rejecting the noise.

Now in the past, the only way to test a dish was to put it on a test range, feed it signals from a known microwave source, and plot a reception pattern. Then a few clever engineers worked out a method of antenna pattern plotting using noise from the sun. It works rather well but requires some test gear. A less accurate but easy way is to build a mating template that follows the ideal dish curve, place it in the dish, and hope it fits like a glove.

Doing It With Mirrors

But hauling a large template to a dealer or satellite show is not too practical. There must be a better way. And, of course, there always is, but long after you've completed the job, according to Murphy's law. Here's an easy trick I use to spot-check a dish. It's a real trial by fire. Simply place a small mirror anywhere on the reflector surface as seen in Fig. 2. Then point the dish at the sun and look where the reflected rays go. They should bounce right into the feedhorn!

If you imagine, for a moment, the sun as just another satellite, then the sun's rays should always hit the feed or else that particular portion of the dish isn't accurate. Try several spots on the dish. If the sun's rays don't make it, neither will microwaves! Right?

There are a few caveats to doing this test. First, use a small mirror. Less than 3 inches (one wavelength) is necessary. A larger mirror will only make things look worse. Second, crawling on a mounted dish isn't too safe no matter what latitude you're at. So the best method is to tape the mirror to a long pole or piece of wall molding as seen in Fig. 3 and move it around the surface. Third, wear dark glasses. You'll be looking almost directly at the sun. And fourth, don't be afraid of frying the LNA with this test. A flat mirror doesn't magnify. So a moment's reflection (despite the pun) will remind you that you are not increasing the LNA temperature more than you would if you simply pointed the bare LNA at the sun!

Feeds Are the Culprits

Perhaps you recall from last month's discussion that feeds limit antenna efficiency to the 50% to 60% range because their sensitivity pattern cannot adequately cover a dish. See Fig. 4. The ideal feed pattern would be flat as a pancake across the top and drop to zero at the sides. But that's not all. The manufacturer of this fabled horn would need several models, one for each size dish, because any overshoot by the horn would add a considerable amount of terrestrial noise to the signal and breed the dreaded "sparklies" faster than rabbits.

Back now to the real world. A lot of work was done on feedhorns in the '60s, mostly by radio astronomers. Their ideal feed overshoot occurs when the edges of the dish are illuminated at a level which is −15 to −20 dB down from the center. As a practical matter, TVRO designers use the −10-dB point on the curve. At the moment, several manufacturers offer nearly identical feeds that cover a narrow range of dish sizes and F/D ratios. Depending on dish size, a typical horn will operate over an F/D range of .3 to .5 with moderate efficiency. F/D is simply dish focal length divided by the diameter. Some companies will design a feedhorn for your specific dish. All that varies is the flare angle of the horn, which directly affects the angle of the illumination pattern.

Watch For Sleight Of Hand

If you see a demonstration where a small dish is used and the pictures look fine, stop and ask yourself if the salesman is showing you only the best transponders. Test your suspicions by asking if you can do the tuning. Then try all the transponders. RCA birds (Satcom) have 24 transponders, while Western Union birds (Westar) have only 12. Not all transponders lay the same footprint levels in a given area, so you must test. In many cases, you may find the test being conducted on a bird which may have a hot footprint in your area. Ask to see what all the transponders look like on other birds. It may be wise to have a log of what is available. A complete list of program sources and times on all the satellites is available from *Satellite TV Week*, PO Box 308, Fortuna CA 95540, (707)-725-2476. Cost is $48/year or $65/year, first class.

You may discover when you have free reins on the tuning knob that many transponders are buried in the sparklies. Throw the salesman off guard by asking why! The answers you get may cause you to reconsider a purchase. Be prepared for the interference argument. It may be valid. Quite often you may discover that satellite TV in your area will be plagued with interference from Ma Bell. At this point, you must be on special guard because location of the dish becomes very important. While your house can make a dandy shield to a direct signal, you must also narrow your search to a very high integrity dish so the side-lobe levels are at their lowest. This problem may cause you to re-think your location. A large rf fence is an eyesore even to the most understanding wife.

Of course you can stifle the interference to some

degree with notch filters in the receiver i-f. As a rule, Ma Bell carriers are located plus and minus 10 MHz from the center of a typical transponder. If you install notch filters at 60 and 80 MHz in a typical 70-MHz i-f amplifier, the interference will be drastically reduced and may turn an otherwise unwatchable picture into something that can be viewed, though not fully appreciated as studio quality, mainly because notch filters remove some of the signal you want to receive!

Magic Without Mirrors

Antennas for TVROs are no more different than for any other service when it comes to the rock-solid basics. But you must be on the lookout for magical claims because this field is new to the entrepreneur types who sell only the sizzle. There is a tendency among many (including myself) to buy a product because the advertising is slick or the numbers in the ad fit your calculations and pocketbook.

The problem is "newness." If you see everyone getting fantastic pictures with an Acme Whizbang Launcher, then it must be pretty good. But very few people even know what a TVRO is, let alone a Whizbang whatever. So it's up to you to break the new ground, to make the mistakes. . . and claim the victories. Just be careful and remember that a wise man always looks before he leaps.

The time is right for you to join in the fun of receiving TV from space. If you have a question regarding the topics we cover here, feel free to drop me a line (letters only, no calls please). Sorry, I can only answer mail that is accompanied by an SASE. ■

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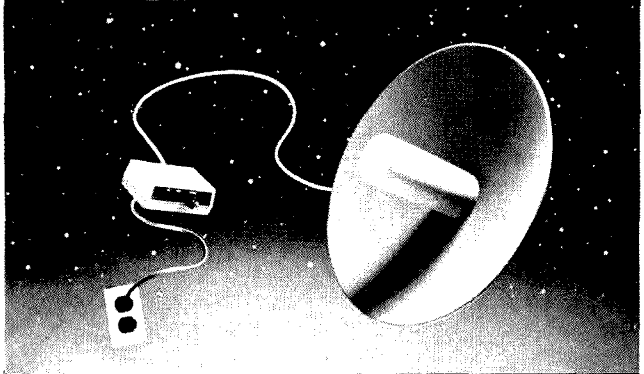

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Taylor Howard: TVRO Trailblazer

Tim Daniel N8RK
73 Magazine Staff

Taylor Howard W6HD has been called many different names. He didn't mind when the Australian government nicknamed him the "Crazy Professor," but when opponents of the home-TVRO industry labeled Howard as a "pirate," he got mad. "There are pirates out there," Tay Howard freely admits, "but why should I be prohibited from receiving signals that I can't get any other way?"

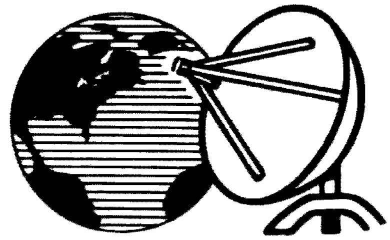
For Dr. Taylor Howard, the future of satellite TV is a very serious business. Ever since he built the world's first private Earth station, W6HD has been in the forefront of the battle to legitimize the infant home-satellite-TV industry. The debate centers on the availability of services. Howard just wants access to the same entertainment and information that cable TV customers can get.

"I don't want to be a second-class citizen just because I don't live in a condo in New York" is his argument. Without missing a beat he goes on to acknowledge the need for Earth-station owners to pay a fair price for these services.

Tay Howard brings a unique viewpoint to the upstart TVRO field. His heart really lies in the workshop or laboratory, not in a congressional hearing room or courthouse. Howard, along with another ham, Robert Coleman, built the first satellite receivers that the average hobbyist could duplicate. The original Coleman-Howard design is at the root of most of the commercial receivers sold today. Other W6HD innovations include specialized TVRO test gear and a low-cost method of changing the polarity of a feed.

Today, Dr. Howard devotes most of his time to serving the TVRO industry as a spokesman and consultant, but he remains on the faculty at Stanford University where he contributes to NASA's deep-space exploration program. A major chunk of his time has been spent as member and the first President of SPACE (Society for Private and Commercial Earth Terminals), which represents the terminal owners and manufacturers.

The nickname "Crazy Professor" was given to W6HD when he proposed a satellite reception scheme for Australia's outback. Government officials said it couldn't be done—that the signals just weren't strong enough. Howard chose to ignore the doomsayers. After building a big spherical antenna, he attached a receiver and then sat back to watch TV. The aborigines, the government, and even some of Howard's backers were amazed. There wasn't any magic involved; Howard knew that the theory permitted success, but only if someone took the time to try.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In his quiet, yet confident manner, Taylor Howard offered the following thoughts:

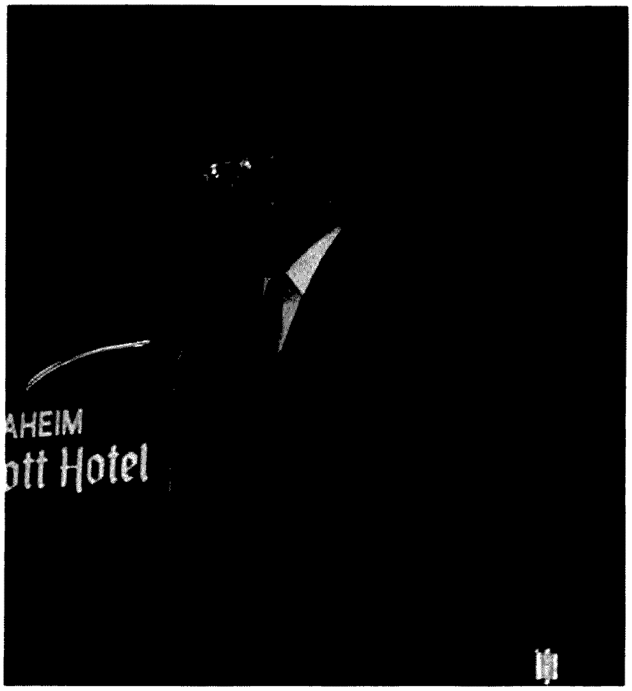
● 12-GHz Direct Broadcast Satellites: Aren't the 4-GHz satellites already direct broadcast? Technically, 12 GHz is not that far away. The problems are legal. Even the Europeans are having trouble. There is no way to limit the pattern of a satellite's signal to a country's geographical borders. The threat of cultural imperialism must be solved before the world is ready.

● Impact of Video: Satellite TV can have a positive effect on people's lives. It brings them into the mainstream of life regardless of where they live. Modern kids are pretty good about television. They know the difference between good and bad.

● Microwave Technology: Signal processing has been the downfall of the microwave industry. We need to learn how to integrate the entire system into one package. This would help reduce the expense for uplinking to satellites.

● Opportunities: Hams are a natural for getting involved in the satellite-TV field. We are totally short of competent people. There could be employment for every ham in the country. You need both digital and rf knowledge and the ability to combine the two. An understanding of transmission-line theory is important.

● Appliance Operators: There are lots of hams who are yakkers; you might say that they have a PhD in CB. But that is okay; we need people like that. I've always been technically inclined and will protect the individual experimenter.



Taylor Howard W6HD.

You won't find Tay Howard with a patch over his eye, stalking the deck of a galleon. Look for him in the Australian wilderness, a college laboratory, or in his dish-filled backyard. He won't be searching for buried treasure. Instead, he may be gazing skyward. Taylor Howard is a pioneer, not a pirate, and for him, satellite television is going to be "big, very big; we haven't seen anything yet!" ■

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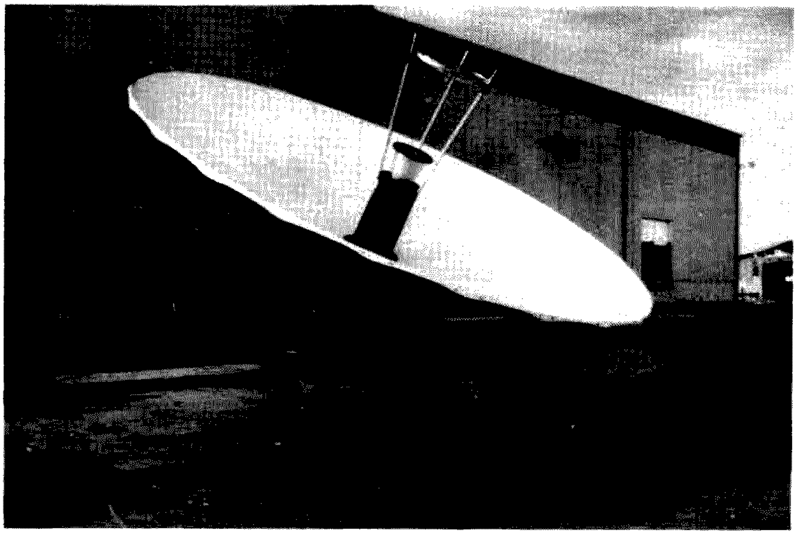

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TVRO Q & A

—advice from WB0POP—part II

Ken Rae WB0POP
737 South Clarkson
Denver CO 80209

I found a great deal for a surplus antenna. The only problem is that it's bent. Can it be straightened?

Dents in a metal dish usually can be pushed out with a piece of wood. If the dish is warped from rim to rim, the antenna is probably hopeless unless you remold the entire surface. If the cure is not simple, then start looking for another antenna.

Fig. 1. A wooden template can be used to check the accuracy of an antenna surface.

How can I measure the accuracy of a dish?

The first step is to find the focal point and diameter. Next, using the appropriate equation, draw an accurate representation of the parabolic curve on a large piece of paper. This paper model can be used to make a wooden template that can be lined up against the dish to check its accuracy—see Fig. 1. (The most useful type of template has two of these "half moons," mounted at right angles.) You can check the rim by laying the dish face down, on a flat surface like a level concrete floor. A quick field test can be made by stretching two strings across the dish at right angles (see Fig. 2). A deflection or gap between the two strings indicates that part of the rim is bent or warped. If the rim is true, the two strings should just touch in the middle.

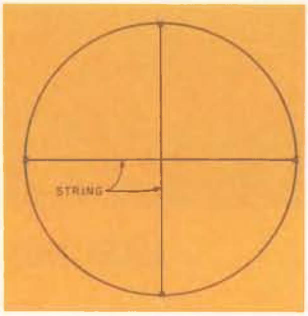

Fig. 2. Two pieces of string stretched at right angles should just touch the middle if the rim of the dish is true.

A friend of mine is thinking about buying an oval-shaped dish. The price is right, but will it work?

Unfortunately, an oval-shaped antenna would be next to useless, no matter what the price. The bore sight of an oval dish is not circular, so you will receive a mixture of horizontally- and vertically-polarized signals. This is unacceptable for conventional TVRO work.

What are my chances of finding an appropriate surplus dish?

You might be better off searching for a bikini-clad beachcomber in Denver during the dead of winter. The tremendous interest in TVRO has made surplus antennas a scarce commodity. There are a few hiding in corners of junk yards waiting to be scrapped. Others are being retired from commercial service. In any case, you'll have to do a lot of looking and have the right contacts.

I can't find a surplus antenna, nor can I afford to buy a new dish. What is my next option?

You can build your own antenna. The spherical de-

sign is probably a little bit cheaper and easier to duplicate than a parabolic, but it is also less versatile. If you are good at scrounging materials, you can build either a parabolic or spherical antenna for $100 to $400. However, don't underestimate the amount of work involved.

What about building a stressed dish?

Amateurs have been experimenting with this type of parabolic antenna for many years. Unfortunately, most stressed-type designs are not intended for continuous exposure to the elements. For best results, a stressed antenna must be guyed in position, eliminating the ability to change satellites easily.

Is there a simple way to spot potential obstructions between my antenna and the satellites?

Go to your tentative site and look due south. Raise your arm to about 45 degrees from horizontal. Sweep your arm across the sky, dropping it down as you move to the east or west. If you live in the central United States, this will give you a rough idea of the satellites' location. If there are trees, buildings, or other obstructions that look risky, take the time to run a serious check on the site.

What is the maximum distance I can have between my TV set and the satellite antenna?

If you are using a single-conversion receiver where the downconverter is located at the antenna and a 70-MHz signal is sent to the house, there can be as much as a 100-foot run of RG-8/U coaxial cable (or perhaps a good grade of RG-58) without losing a noticeable amount of the signal due to cable loss. If your system requires that you relay a 4-GHz signal, it will be necessary to run hardline or heliax cable, which costs as much as $4 per foot, or about ten times the cost of RG-8/U. If you do use a good grade of hardline, it can usually be 80 to 100 feet long before the losses catch up and degrade the picture. Line amplifiers can be added to increase this distance, but the cost may be prohibitive.

My neighbor is considering installing her own TVRO. Could that interfere with my system?

Just as hams living next to each other sometimes have interference problems, so can adjacent TVRO systems. The difficulty usually stems from local oscillator (LO) leakage. This unit typically has 10 milliwatts of output, and if it is not well shielded, a signal will be radiated. If your neighbor wants to receive a signal on the same frequency that your LO is operating on, there could be a problem. Dual-conversion receivers or well-shielded single-conversion designs go a long way towards reducing the interference.

What is an Az-El mount?

This type of mount allows you to move a dish vertically (El) and horizontally (Az). In my opinion, this is the hard way to do things unless you are chasing satellites that move, like Russia's Molniya birds. If you'll be watching only the geosynchronous satellites, a polar mount is probably more useful.

OK, what's a polar mount?

The polar mount allows you to rotate the dish from east to west or vice versa and keep the axis of the dish in line with the axis of the Earth. You can align the axis for a polar mount by using the North Star as a guide. When you sweep your dish across the sky, it will not be necessary to make any significant adjustments in the elevation if you have a polar mount.

What is a "tree" mount?

There is no strict definition for a tree mount. All you do is prop your dish against a handy tree, the side of a building, or anything else that is convenient. This kind of mount is useful if you are in too much of a hurry to build a polar or Az-El mount.

How do I center the feedhorn on a dish?

To place the feedhorn at the focal point requires measurement from the center of the feedhorn's mouth to the edge of the dish. This distance should be the same to all points on the edge.

When I was positioning my feedhorn, I found a better signal when the horn was slightly off center. Why?

If your signal improves when the horn is not centered, there may be two culprits: The dish is not pointed directly at the chosen satellite or the antenna's surface is warped, causing the actual focal point to differ from the theoretical focus. A distorted dish may have one or more false "hot" spots. On a well-built dish that is pointed directly at the satellite, your best signal will be found when the feedhorn's mouth is at the calculated focal point.

I have a good dish and I know it is pointed right; I still get two hot spots, one at the edge of the feedhorn mouth, the other just inside the horn. What gives?

When you move the horn back and forth through the focal point, there will be two distinct "hot" spots. The wave pattern has an hourglass shape since the impedance seen by the arriving signal changes according to the distance. The hot spot that is closest to the dish is the most efficient because it offers a narrow bore sight. This means that the focal point will lie about ¼ to ½ inch inside the horn.

When placing the horn, which is more critical, moving the mouth from side to side or moving it towards and away from the dish?

A two-inch shift to one side can result in as much as a 3-dB drop in signal level while a two-inch movement in or out will result in a 1-1.5-dB loss. Concentrate on lining up the side-to-side dimension.

As I sweep my dish across the sky, there is a slight "image" signal about four degrees on either side of the bore sight position for a particular satellite. What is this?

I discovered the same thing when I was installing a new antenna. First I thought it was a new satellite. After disproving that theory, I spent many hours carefully refocusing my antenna. Finally, after a lot of reading, I discovered that any parabolic antenna that is not perfect will exhibit side lobes. These will allow you to receive signals that are much weaker than those you find with the major lobe pointed at the satellite. The better the dish, the less prominent the side lobes.

Why do I receive vertical transponders better than horizontal transponders on the same satellite?

On Satcom F1, the vertical transponders were slightly stronger than the horizontal ones, but the one-half-dB difference was not enough for most hobbyists to notice. If you have a noticeable difference between the two polarities, it may be the result of inaccuracies in the antenna's surface. ■

Timothy Edwards
c/o Ambit International
200 North Service Road
Brentwood, Essex CM14 4SG
England

VHF Converter

—easy to build, yet state of the art

Editor's Note: This state-of-the-art VHF converter design is reprinted from the British publication *Radio and Electronics World*. A complete parts kit is available from RadioKit, Box 411, Greenville NH 03048. The special TOKO coils are available from Ambit International, 200 North Service Road, Brentwood, Essex CM14 4SG, England.

Despite the plethora of ready-made equipment for the 2-meter (144-148 MHz) amateur communication band, most radio enthusiasts like to try to salve their consciences as participants in the once exclusively "practical" art of amateur radio by making at least one or two items of equipment that can justifiably be described as "home grown."

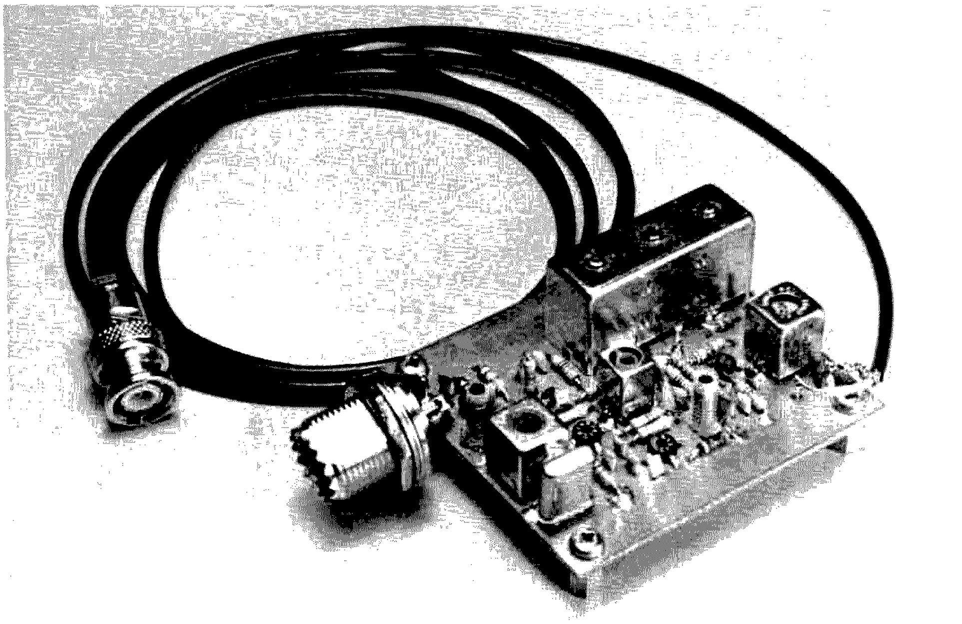

Photo A. The finished unit with cable.

Most of the commercial transceivers for the VHF bands are primarily FM systems for simply "nattering," and some of the hobby's traditionalists might suggest that the use of 2m NBFM bears more than a passing resemblance to the principles behind CB radio—but that's an entirely more contentious subject. . .

The exclusive use of NBFM tends to overlook the more interesting aspects of CW and SSB communications (Morse code and single sideband to the uninitiated). But since most enthusiasts have an HF communications receiver (or two) at their disposal, it is an easy enough task to

Specifications

Noise figure	less than 2 dB
Gain	28 dB nominal
3-dB bandwidth	144-146 MHz
I-f output	28-30 MHz
1-dB compression	+ 5-dB output
Saturated output	+ 7 dBm
Supply voltage	8-16 V
Supply current	15 mA nominal
In-out impedance	50 Ohms
Size	70 × 60 × 20 mm

make a thoroughly professional converter for 144-146 MHz, with an i-f output to be tuned on the 28-30-MHz section of the HF receiver. The radio enthusiast may thus fulfill the repressed constructional instinct, as well as be able to have a serious look at the CW and SSB aspects of the 2-meter band before launching into a few hundred dollars worth of oriental temptation.

The converter is basically a linear device within the expected range of input signal levels, so any mode (AM, FM and SSB) can be converted to the required HF output. Some HF receivers are available with NBFM demodulators, but to do the job properly, the correct bandwidth i-f filter needs to be used with a purpose-made NBFM i-f system. In the absence of this facility, slope detection of NBFM is better than nothing. (Slope detection relies on the i-f filter passband edge to translate the frequency modulation information into an amplitude variation for detection as simple AM.)

Judging by the numbers of "nearly new" SSB transceivers advertised for sale, it is no doubt better to investigate your long-term interest in this aspect of communication without first contributing to the wrong side of the balance of payments. This converter provides reception of repeaters, NBFM simplex, and demanding long-range communications using CW or SSB.

The 2-Meter Converter

This converter was originally designed to complement the RX80 receiver described in the British magazine *Radio Communication*, although it will obviously operate with such receivers as the FRG-7, R1000, DX160, etc. It has been designed with the latest state-of-the-art components, notably the NEC 3SK88 MOSFET which has been chosen for its repeatably low noise figure and low cost. The TOKO CBT series helical filter provides an outstanding bandpass and stopband response, but most significantly of all from the point of view of those of you wishing to duplicate this converter, it is supplied prealigned and requires virtually no trimming to optimize alignment.

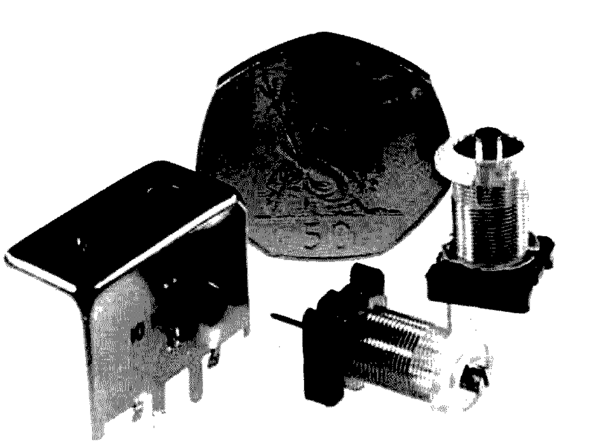

Photo B. An exploded view of the 2-pole version of the helical filter.

Although a VHF converter usually requires considerable expertise and recourse to a selection of signal generators and other analytical equipment, the converter can be built by anyone with kit building experience and a multimeter.

Circuit Description

Fig. 1 shows the complete circuit diagram. C1, C2, and L1 provide the optimum noise match between the 50-Ohm antenna input and the rf amplifier—this is a carefully derived selection of values, and not simply a haphazard choice from the junk box. Gate 2 of Q1 is biased at 5 V (externally derived—i.e., from the main receiver or tuneable i-f—negative-going agc may be applied at this point by those with adequate confidence and experience). The source of the rf amplifier, Q1, is then taken directly to ground to ensure minimum impedance.

The drain of Q1 is taken to the supply through R3, which provides the correct terminating impedance to the helical resonator, L2,

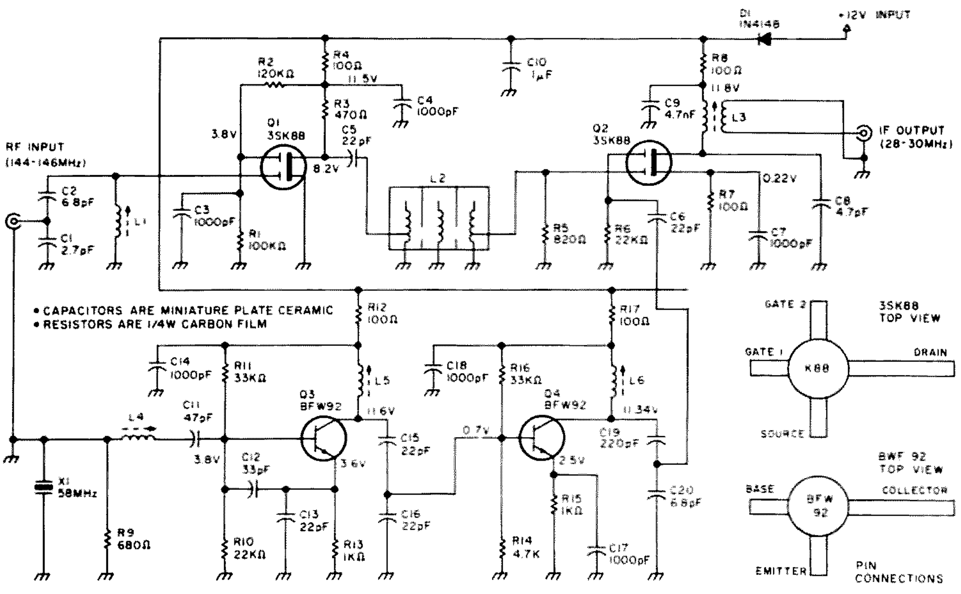

Fig. 1. Circuit diagram.

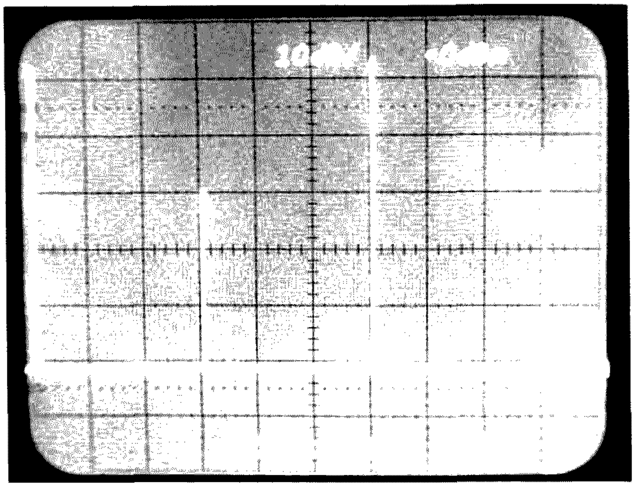

Photo C. The spectrum of the LO multiplier output (10 dB per vertical division, 20 MHz per horizontal division).

which has an input and output impedance of approximately 450 Ohms. The output of L2 is connected straight to the gate of the mixer, Q2, R5 providing the necessary extra load in parallel with gate 1 of Q2 for a correct 450-Ohrn matching load.

The appearance in the market of low-cost helical filter blocks (Photo B) will probably change the approach to VHF designs, since yet another circuit variable has now been substituted by a building block that takes out most of the problems for the less-experienced designer and user. More than 75% of the problems associated with VHF radio designs are simply those associated with getting lost in the MHz as a result of the uncertainties of DIY coil designs.

Helical filters will not salvage designs that fall into the all-too-familiar abyss of "dry" joints and a shortage of basic experience in handling components and a soldering iron—but these filters will help allay the fears of the more experienced audio constructor whose neat rf projects have always been relegated to the "pending" tray, since the problems of alignment associated with the green fingers of the rf engineer sometimes seem insurmountable.

Unlike the rf amplifier, the mixer does not use any dc bias on either of its gates. This is because the amplitude of the local oscillator injection voltage is designed to be sufficient to switch Q2 *directly* at 116 MHz, thereby improving the intermodulation performance of the converter. This technique is used in some professional receivers and is similar in concept to the esoteric Schottky diode double balanced mixer—except, of course, that this system is single ended. It is possibly the first time that this approach has been used in an enthusiast's constructional feature. Unless you know better...

At the drain of Q2, the wanted mixer product (28-30 MHz) is selected in the tuned circuit formed by L3 and C8 and matched at the secondary to 50 Ohms to feed the main receiver. It is this output network that mainly constitutes the 3-dB bandwidth of the converter. This means that the gain is approximately 25 dB at 144 MHz, 28 dB at 145 MHz, and 25 dB at 146 MHz. This reduction of gain is of no consequence as the design has plenty in hand at all times.

It should be noted that the ultimate sensitivity of any receiving system is defined by its noise figure and *not* its gain. This means that the sensitivity will be the same over at least 144-146 MHz, although the S-meter might read slightly less at the band edges.

The oscillator chain uses a 38.667-MHz crystal rather than the more usual 116-MHz type. Transistor Q3 serves the function of both oscillator and frequency doubler. L4 tunes out the capacitive reactance presented to the third overtone crystal and allows fine adjustment of its operating frequency. L5, C15, and C16 select the third harmonic from the oscillator at 116 MHz and match it into Q4 where it is amplified to an adequate level to switch the mixer, Q2. The capacitive divider, C19 and C20, provide the necessary level and impedance adjustment to feed the oscillator injection of approximately 2 mW to gate 2 of Q2.

On a general point about decoupling, note the way in which tuned circuits are decoupled with capacitance and inductance. Taking the example of L3 (R8/C9), R8 is apparently superfluous.

This presumes that there is zero ac impedance to the rf ground on the positive supply rail which—for reasons of the effects of lead inductance and the unpredictability of stray coupling at VHF—is certainly not always the case. Thus the low-pass filter formed by the RC combination provides a far more positive and reliable method for keeping the rf off the supply line. The danger of creating a positive feedback loop somewhere in the physical (as opposed to the-

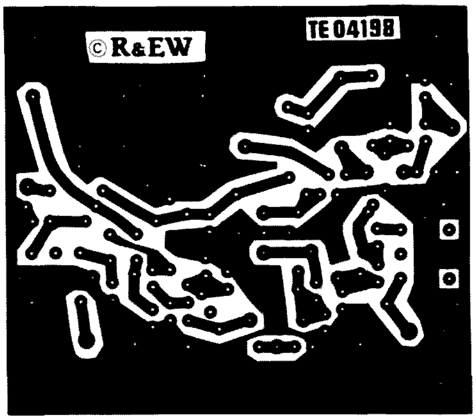

Fig. 2. PC board layout.

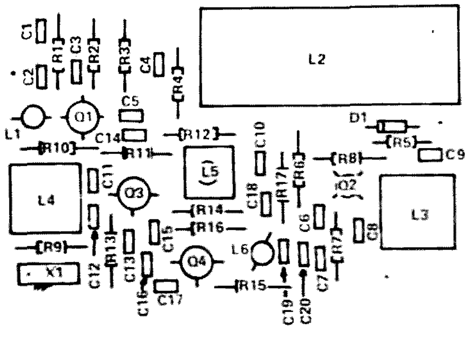

Fig. 3. Parts placement.

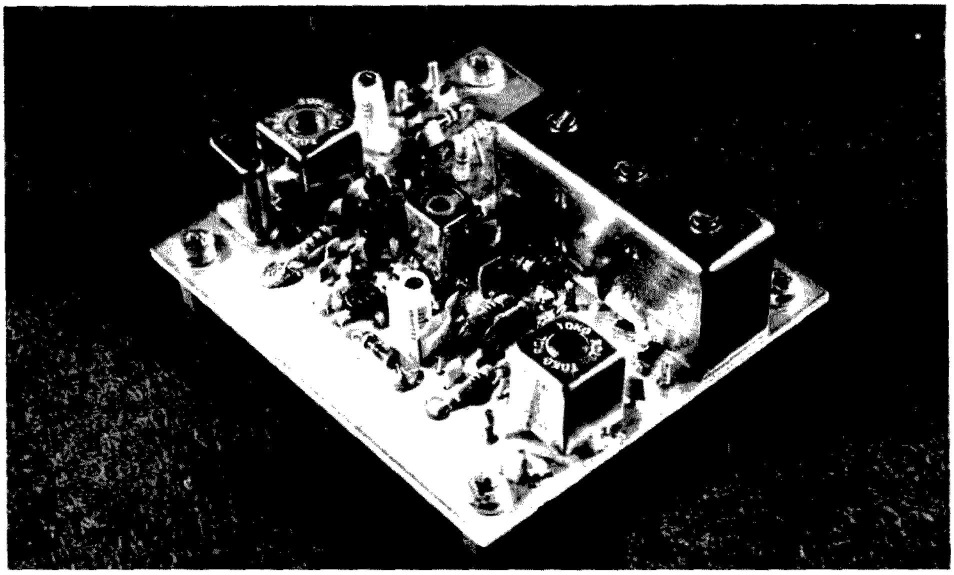

Photo D. The completed converter PCB.

oretical) circuit layout is thereby greatly reduced.

D1 provides reverse polarity protection, which most readers with practical experience will have discovered is essential when connecting things up in a hurry. Strangely enough, this simple and effective precaution is omitted from many designs. Perhaps more components get sold that way.

Construction And Alignment

Using the PCB and components placement guide (Figs. 2 and 3), assemble the converter. Do not forget to solder the earthy legs of R1, R5, R6, R7, R9, R13, R14, and R15—and also the can legs of L2, L3, L4, and L5. There are no critical or easily-damaged components, although due to their size it is advisable to leave the coils and helical filters until last.

After construction is completed, remove any solder splashes, check for dry joints, and remove the flux residue. Connect to a 12-V regulated power supply and check that the current consumption is about 10 mA without the crystal fitted.

Preset coils L1, L5, and L6 so that their cores are flush with the top of their formers. At this stage, do not touch L2, L3, and L4.

Connect a voltmeter between Q3 emitter and ground; the voltage should be approximately 3.2 V. Plug in the crystal, and the voltage should rise to about 3.5 V; slightly adjust L4 for maximum reading. Transfer the meter to Q4 emitter, and adjust L5 for maximum reading—which will be about 3.5 V. If the crystal is removed, the voltage will fall to approximately 0.48 V. Transfer the meter to the source of Q2 and adjust L6 for maximum reading. This will be about 0.15 V to 0.3 V, depending on the IDSS of Q2; there will be less than 0.1 V present with the crystal removed.

Connect a 50-Ohm aerial to the 2-meter input and a suitable receiver to the output via a 50-Ohm coax lead. Don't bother to tuck it all away neatly into a case/box just yet, since there is a reasonable chance that you will need to do some work on the unit to get everything working perfectly.

Tune to a weak signal around 145 MHz (the output will tune to 29 MHz) and adjust L3 for maximum output using the receiver's own S-meter. Adjust L1 for maximum signal-to-noise by ear, and do *not* use the S-meter if optimum results are required. Maximum gain does *not* coincide with minimum noise figure.

Unless you have the necessary equipment to sweep the 2-meter band with a spectrum analyzer and signal generator, do not adjust L2. There is little point anyway, as the helical resonator has been very accurately set up during the course of its manufacture and test, and no improvement could be effected on the samples tested. This is not unexpected, as TOKO offers an unparalleled repeatability in their ranges of high quality rf and i-f coils. Experience has shown them to be suitable for most demanding applications, and, indeed, there are hardly any high-quality receivers that do not use some.

The bandpass characteristic over 144-146 MHz shows a perfect textbook response (Photo C). The helical filters were originally designed for use by manufacturers of Oriental "black boxes." If you take the lid off some Kenwood and Standard equipment, you probably will find one of these devices lurking near the receiver front end.

The remaining adjustment is to put the converter onto the correct frequency, but this is not important unless the receiver itself has an accurate frequency readout. If it has, then tune to a known frequency such as a beacon signal or a repeater and adjust L4 so that output frequency corresponds to the known input signal. For example, a repeater on R6 (145.75 MHz) reads 29.75 MHz on the main receiver display.

This completes the alignment, and it is gratifying to be able to comment that no problems have occurred with stability in any examples tested so far—doubtless due to the carefully designed double-sided printed circuit board.

Conclusions

Once you are confident that all is well, fit the completed PCB into an appropriate container and fit

Parts List

(Capacitors are miniature plate ceramic.)
C1—2.7 pF
C2, C20—6.8 pF
C3, C4, C7, C14, C17, C18—1000 pF
C5, C6, C13, C15, C16—22 pF
C8—4.7 pF
C9—4700 pF
C10—.1μF
C11—47 pF
C12—33 pF
C19—220 pF
(Resistors are ¼ w carbon film.)
R1—100k Ω
R2—120k Ω
R3—470 Ω
R4, R7, R8, R12, R17—100 Ω
R5—820 Ω
R6, R10—22k Ω
R9—680 Ω
R11, R16—33k Ω
R13, R15—1k Ω
R14—4.7k Ω
(All coils are TOKO brand.)
L1, LS, L6—MC108, 7.5 turns
L2—272MT—1006A
L3—154FN6439
L4—KXNK3766
Q1, Q2—3SK88
Q3, Q4—BFW92 or 2N918 (Watch pinout)
X1—38.667 MHz HC18U crystal
D1—1N4148
Misc: 7 mm Coil Can, printed circuit board.

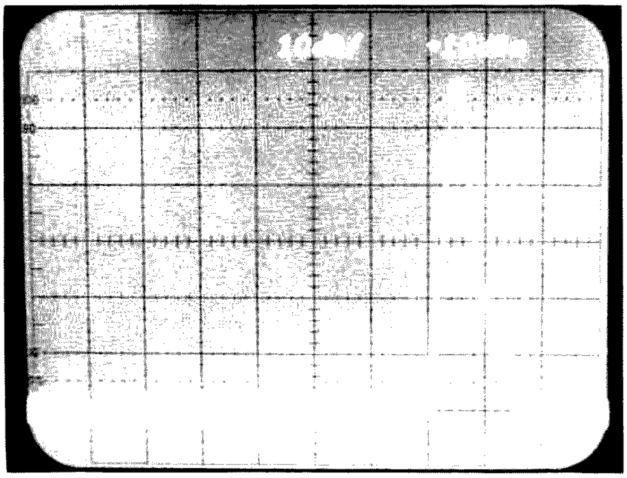

Photo E. Bandpass at mixer input (10 dB per vertical division, 10 MHz per horizontal division).

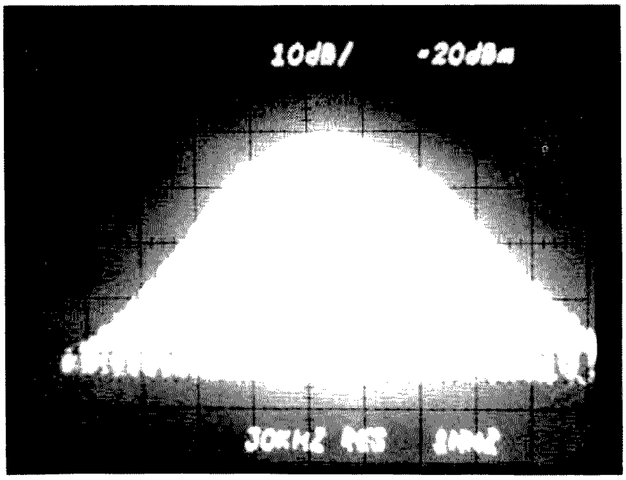

Photo F. The converter bandpass (2 dB per vertical division, 1 MHz per horizontal division).

some form of rf connector such as PL259 or BNC. If you do not already possess a standard of your own, then the BNC system is probably the best choice. Fitting a BNC connector to a cable is not the easiest task for the uninitiated, but it is worth persevering and acquiring the necessary skills, since the BNC system is probably the best general-purpose rf connector available.

The spectrum analyzer photographs were taken using Tektronix and Hewlett Packard test equipment. Because the input and output frequencies are not the same, it was not possible to use the conventional technique of sweeping a tracking generator with the spectrum analyzer. Instead, a Hewlett Packard 8640B signal generator was swept by hand over 130-160 MHz while the spectrum analyzer was tuned to a center frequency of 29 MHz. The resulting display was stored in the analyzer and photographed with a Polaroid camera. The results speak for themselves and, best of all, are entirely repeatable.■

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Compugrams Are Here

—BASIC message handling

William M. Kahn WA6ZZL
13450 Highway 8, Space 3
Lakeside CA 92040

When I first began handling formal message traffic, I was impressed with the professional "Western Union" look of the amateur radiogram forms published by the ARRL. Several months later, the romance ended as I reorganized desk drawers for the umpteenth time to make room for my ever-growing message file.* So, I began to design a program

***FCC regulations (Section 97.105) require retention of third-party traffic for one year.**

Program listing.

```
1 REM * ARRL RADIOGRAM FORMAT *
2 REM * BY WILLIAM M KAHN, WA6ZZL *
3 REM * 13450 HIGHWAY 8 SPACE 3 *
4 REM * LAKESIDE  CA 92040 *
10 CLS:PRINT@20,"ARRL RADIOGRAM FORMAT"
20 PRINT@72,"THIS PROGRAM WILL RECORD AND STORE 10 MESSAGES"
30 FORX=1TO1500:NEXT:CLS
40 CLEAR3200:INPUT"SELECT (1) KEYBOARD OR (2) TAPE INPUT";Y:CLS:IFY=2THEN3000
70 M=0
80 FORM=M+1TO10:PRINT@0,M:INPUT"HEADING";H$
90 INPUT"TO";N$:IFA=2THEN190
100 INPUT"ADDRESS";A$:IFA=3THEN190
110 INPUT"LOCATION & ZIP";L$:IFA=4THEN190
120 INPUT"PHONE";P$:IFA=5THEN190
130 INPUT"CORRECTIONS: 0=NONE, 1=HEAD, 2=TO, 3=ADD, 4=LOC, 5=PHONE";A:IFA=0GOTO200
140 IFA=2THEN90
150 IFA=3THEN100
160 IFA=4THEN110
170 IFA=5THEN120
180 IFA=1INPUTC$
190 INPUT"MORE CORRECTIONS (1=YES, 0=NO)";A1:IFA1=1THEN130
200 INPUT"TEXT & SIGNATURE";T$:PRINTLEFT$(H$,6)
210 INPUT"RECEIVED FROM";R$
212 IFM=2THEN240
214 IFM=3THEN250
216 IFM=4THEN260
218 IFM=5THEN270
220 IFM=6THEN280
222 IFM=7THEN290
224 IFM=8THEN300
226 IFM=9THEN310
228 IFM=10THEN700
230 H1$=H$:N1$=N$:A1$=A$:L1$=L$:P1$=P$:C1$=C$:T1$=T$:R1$=R$:GOTO600
240 H2$=H$:N2$=N$:A2$=A$:L2$=L$:P2$=P$:C2$=C$:T2$=T$:R2$=R$:GOTO600
250 H3$=H$:N3$=N$:A3$=A$:L3$=L$:P3$=P$:C3$=C$:T3$=T$:R3$=R$:GOTO600
260 H4$=H$:N4$=N$:A4$=A$:L4$=L$:P4$=P$:C4$=C$:T4$=T$:R4$=R$:GOTO600
270 H5$=H$:N5$=N$:A5$=A$:L5$=L$:P5$=P$:C5$=C$:T5$=T$:R5$=R$:GOTO600
280 H6$=H$:N6$=N$:A6$=A$:L6$=L$:P6$=P$:C6$=C$:T6$=T$:R6$=R$:GOTO600
290 H7$=H$:N7$=N$:A7$=A$:L7$=L$:P7$=P$:C7$=C$:T7$=T$:R7$=R$:GOTO600
300 H8$=H$:N8$=N$:A8$=A$:L8$=L$:P8$=P$:C8$=C$:T8$=T$:R8$=R$:GOTO600
310 H9$=H$:N9$=N$:A9$=A$:L9$=L$:P9$=P$:C9$=C$:T9$=T$:R9$=R$
600 A=0:C$=" ":INPUT"PROCESS MORE TRAFFIC (1=YES, 0=NO)";P:CLS:IFP=0THEN700
610 NEXT M
700 GOSUB20000:IFM=10THEN1000
710 INPUT"ENTER MORE TRAFFIC THIS SERIES (1=YES, 0=NO)";P:CLS:IFP=1THEN610
1000 GOSUB30000
1010 INPUT"PROCESS MORE TRAFFIC (1=YES, 0=NO)";P:IFP=1THEN40ELSE9999
3000 PRINTTAB(10);"MESSAGE RETRIEVAL AND UPDATE SECTION":PRINT
3010 INPUT"PREPARE TAPE - PRESS ENTER WHEN READY";X:CLS:PRINT"LOADING"
4000 INPUT#-1,M
4010 INPUT#-1,H1$,C1$,N1$,A1$,L1$,P1$,R1$:INPUT#-1,T1$,S1$:IFM<2THEN4110
4020 INPUT#-1,H2$,C2$,N2$,A2$,L2$,P2$,R2$:INPUT#-1,T2$,S2$:IFM<3THEN4110
4030 INPUT#-1,H3$,C3$,N3$,A3$,L3$,P3$,R3$:INPUT#-1,T3$,S3$:IFM<4THEN4110
4040 INPUT#-1,H4$,C4$,N4$,A4$,L4$,P4$,R4$:INPUT#-1,T4$,S4$:IFM<5THEN4110
4050 INPUT#-1,H5$,C5$,N5$,A5$,L5$,P5$,R5$:INPUT#-1,T5$,S5$:IFM<6THEN4110
4060 INPUT#-1,H6$,C6$,N6$,A6$,L6$,P6$,R6$:INPUT#-1,T6$,S6$:IFM<7THEN4110
4070 INPUT#-1,H7$,C7$,N7$,A7$,L7$,P7$,R7$:INPUT#-1,T7$,S7$:IFM<8THEN4110
4080 INPUT#-1,H8$,C8$,N8$,A8$,L8$,P8$,R8$:INPUT#-1,T8$,S8$:IFM<9THEN4110
4090 INPUT#-1,H9$,C9$,N9$,A9$,L9$,P9$,R9$:INPUT#-1,T9$,S9$:IFM<10THEN4110
4100 INPUT#-1,H$,C$,N$,A$,L$,P$,R$:INPUT#-1,T$,S$
4110 INPUT#-1,E$:IFE$="END DATA"PRINTE$
4120 PRINT"THIS SERIES CONTAINS";M;"MESSAGES":GOSUB10000
4130 PRINTH1$,CHR$(10);TAB(5);R1$,S1$:IFM<2THEN4220
4140 PRINTH2$,CHR$(10);TAB(5);R2$,S2$:IFM<3THEN4220
4150 PRINTH3$,CHR$(10);TAB(5);R3$,S3$:IFM<4THEN4220
4160 PRINTH4$,CHR$(10);TAB(5);R4$,S4$:IFM<5THEN4220
4170 PRINTH5$,CHR$(10);TAB(5);R5$,S5$:IFM<6THEN4220
4180 PRINTH6$,CHR$(10);TAB(5);R6$,S6$:IFM<7THEN4220
4190 PRINTH7$,CHR$(10);TAB(5);R7$,S7$:IFM<8THEN4220
4195 GOSUB10000
4200 PRINTH8$,CHR$(10);TAB(5);R8$,S8$:IFM<9THEN4220
4210 PRINTH9$,CHR$(10);TAB(5);R9$,S9$:IFM<10THEN4220
4220 PRINTH$,CHR$(10);TAB(5);R$,S$
```

which would allow me to copy traffic directly onto my micro keyboard and store all my third-party messages in a cassette data file.

The program is written in Radio Shack Level II BASIC for the TRS-80 microcomputer and occupies less than 6K of RAM. This includes 3.2K reserved for the string inputs but does not include any overhead for the BASIC interpreter (12K of ROM in the TRS-80). Users of other systems may have to adjust accordingly. As is, this program will handle up to ten messages in the ARRL radiogram format. If you have less available memory, just reduce this capacity to fit your own needs. Any micro with 4K of available RAM should store up to four messages quite nicely.

Operating the program is simple. You begin by making keyboard entries of up to ten messages. The inputs for each message are in the same sequence in which they are normally received off the air (lines 80-200). The transmitting station usually gives a "break" before sending the actual text, and line 130 provides an opportunity to correct any errors or missed copy up to that point. Following the "TEXT & SIGNATURE" input in line 200, enter the information required in the "RECEIVED FROM" section of the radiogram form. The second statement in line 200 recalls the message number and precedence in case the message heading has scrolled off the display screen. (It can be embarrassing to acknowledge receipt of a message when you have forgotten the number.) When you are finished entering traffic, each message entered is displayed in subroutine 20000 and the "STATUS" of each (corresponding to "SENT" on the ARRL form) is entered. You may then continue making entries or dump what you have into a data tape (subroutine 30000).

```
4230 PRINT:INPUT"EITHER (1) REVIEW MESSAGES OR (2) LOAD NEXT SERIES";X:IFX=2THEN4010
4240 GOSUB20000:IFM=10THEN4260
4250 INPUT"MAKE KEYBOARD ENTRIES (1=YES, 0=NO)";X:CLS:IFX=1THEN80
4260 INPUT"RECORD DATA TAPE (1=YES, 0=NO)";X:IFX=1GOSUB30000
4270 INPUT"PROCESS MORE TRAFFIC (1=YES, 0=NO)";X:IFX=1THEN40
4280 INPUT"IF ALL TRAFFIC FOR MONTH IS NOW TAPED, TYPE 1 ELSE TYPE 0";X:CLS:IFX=0THEN9999
4290 INPUT"THIS SECTION WILL RECORD THE END KEY DATA FOR YOUR MONTHLY
SUMMARY PROGRAM.  PREPARE TAPE AND PRESS ENTER WHEN READY";X
4300 M=0:PRINT#-1,M:PRINT
4310 PRINT "THAT'S ALL - THANK YOU":PRINT
9999 PRINT"END SESSION":END
10000 INPUT"PRESS ENTER TO CONTINUE";X:CLS:RETURN
11000 INPUT"ENTER OR CHANGE STATUS (1=YES, 0=NO)";X:RETURN
20000 REM * MESSAGE PRINTOUT SUBROUTINE *
20005 CLS
20010 PRINTH1$;CHR$(10);C1$;CHR$(10);N1$;CHR$(10),A1$;CHR$(10),L1$,CHR$(10);P1$,CHR$(10);CHR$(10);T1$;CHR$(10);R1$,S1$
20020 GOSUB11000:IFX=0THEN20040
20030 INPUT"STATUS";S1$
20040 GOSUB10000:IFM<2THEN20410
20050 PRINTH2$;CHR$(10);C2$,CHR$(10),N2$,CHR$(10),A2$,CHR$(10),L2$,CHR$(10),P2$,CHR$(10),CHR$(10);T2$,CHR$(10);R2$,S2$
20060 GOSUB11000:IFX=0THEN20080
20070 INPUT"STATUS";S2$
20080 GOSUB10000:IFM<3THEN20410
20090 PRINTH3$,CHR$(10),C3$;CHR$(10);N3$;CHR$(10),A3$;CHR$(10),L3$,CHR$(10),P3$,CHR$(10);CHR$(10),T3$;CHR$(10);R3$,S3$
20100 GOSUB11000:IFX=0THEN20120
20110 INPUT"STATUS";S3$
20120 GOSUB10000:IFM<4THEN20410
20130 PRINTH4$;CHR$(10);C4$,CHR$(10);N4$;CHR$(10),A4$,CHR$(10);L4$;CHR$(10),P4$;CHR$(10),CHR$(10).T4$;CHR$(10);R4$,S4$
20140 GOSUB11000:IFX=0THEN20160
20150 INPUT"STATUS",S4$
20160 GOSUB10000:IFM<5THEN20410
20170 PRINTH5$;CHR$(10),C5$;CHR$(10),N5$,CHR$(10),A5$,CHR$(10),L5$,CHR$(10),P5$;CHR$(10);CHR$(10).T5$,CHR$(10),R5$,S5$
20180 GOSUB11000:IFX=0THEN20200
20190 INPUT"STATUS",S5$
20200 GOSUB10000:IFM<6THEN20410
20210 PRINTH6$;CHR$(10);C6$;CHR$(10);N6$;CHR$(10);A6$;CHR$(10);L6$;CHR$(10);P6$;CHR$(10);CHR$(10);T6$;CHR$(10);R6$,S6$
20220 GOSUB11000:IFX=0THEN20240
20230 INPUT"STATUS",S6$
20240 GOSUB10000:IFM<7THEN20410
20250 PRINTH7$;CHR$(10),C7$,CHR$(10);N7$;CHR$(10),A7$,CHR$(10);L7$,CHR$(10);P7$;CHR$(10);CHR$(10),T7$,CHR$(10),R7$,S7$
20260 GOSUB11000:IFX=0THEN20280
20270 INPUT"STATUS",S7$
20280 GOSUB10000:IFM<8THEN20410
20290 PRINTH8$;CHR$(10);C8$;CHR$(10),N8$;CHR$(10);A8$;CHR$(10),L8$;CHR$(10);P8$,CHR$(10);CHR$(10);T8$;CHR$(10);R8$,S8$
20300 GOSUB11000:IFX=0THEN20320
20310 INPUT"STATUS";S8$
20320 GOSUB10000:IFM<9THEN20410
20330 PRINTH9$;CHR$(10);C9$;CHR$(10),N9$;CHR$(10);A9$,CHR$(10);L9$;CHR$(10),P9$,CHR$(10);CHR$(10);T9$,CHR$(10);R9$,S9$
20340 GOSUB11000:IFX=0THEN20360
20350 INPUT"STATUS";S9$
20360 GOSUB10000:IFM<10THEN20410
20370 PRINTH$;CHR$(10);C$,CHR$(10),N$;CHR$(10),A$,CHR$(10),L$,CHR$(10),P$,CHR$(10);CHR$(10),T$,CHR$(10);R$,S$
20380 GOSUB11000:IFX=0THEN20400
20390 INPUT"STATUS";S$
20400 GOSUB10000
20410 INPUT"REVIEW MESSAGES AGAIN (1=YES, 0=NO)";X:IFX=1THEN20000
20420 RETURN
30000 REM * DATA DUMP SUBROUTINE *
30005 INPUT"PREPARE DATA TAPE - PRESS ENTER WHEN READY";X:CLS:PRINT"RECORDING"
30010 PRINT#-1,M
30020 PRINT#-1,H1$,C1$,N1$,A1$,L1$,P1$,R1$:PRINT#-1,T1$,S1$:IFM<2THEN30120
30030 PRINT#-1,H2$,C2$,N2$,A2$,L2$,P2$,R2$:PRINT#-1,T2$,S2$:IFM<3THEN30120
30040 PRINT#-1,H3$,C3$,N3$,A3$,L3$,P3$,R3$:PRINT#-1,T3$,S3$:IFM<4THEN30120
30050 PRINT#-1,H4$,C4$,N4$,A4$,L4$,P4$,R4$:PRINT#-1,T4$,S4$:IFM<5THEN30120
30060 PRINT#-1,H5$,C5$,N5$,A5$,L5$,P5$,R5$:PRINT#-1,T5$,S5$:IFM<6THEN30120
30070 PRINT#-1,H6$,C6$,N6$,A6$,L6$,P6$,R6$:PRINT#-1,T6$,S6$:IFM<7THEN30120
30080 PRINT#-1,H7$,C7$,N7$,A7$,L7$,P7$,R7$:PRINT#-1,T7$,S7$:IFM<8THEN30120
30090 PRINT#-1,H8$,C8$,N8$,A8$,L8$,P8$,R8$:PRINT#-1,T8$,S8$:IFM<9THEN30120
30100 PRINT#-1,H9$,C9$,N9$,A9$,L9$,P9$,R9$:PRINT#-1,T9$,S9$:IFM<10THEN30120
30110 PRINT#-1,H$,C$,N$,A$,L$,P$,R$:PRINT#-1,T$,S$
30120 PRINT#-1,"END DATA"
30130 PRINT"DATA DUMP COMPLETE":RETURN
```

Note the branching arguments and string comparisons in lines 212-310. These allow repeated use of a single string set (H$, N$, etc.) for the inputs and assign the final string names when each message is complete. On the tenth run, there is no change of string names.

Once you have established a message data file on tape, you can make inputs from this file at the beginning of each run (lines 4010-4110). Lines 4120-4220 print the "HEADING," "RECEIVED FROM," and "STATUS" sections of each message for a quick review. You may then either load the next series from the tape or review each message and make additional keyboard entries. Note that if you wish to combine tape and keyboard inputs in the same run, you must make the tape input first. The

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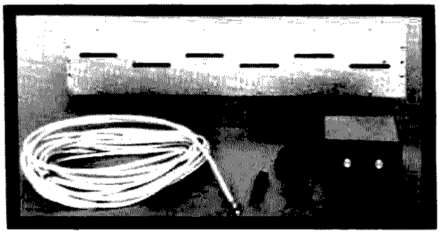

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number of messages available for keyboard input depends on the number loaded from the tape.

Since each "TEXT & SIGNATURE" input is a single string containing a maximum of 255 characters, some kind of line-length control is necessary in order to avoid breaking up words at the end of each line of text. Careful use of the space bar will accomplish this, but it consumes string space in the process. I prefer to use the "down-arrow" key on the TRS-80 keyboard. It performs a line feed/carriage return function without wasting memory and is excellent for separating the signature from the body of the text.

Notice the tape input and data dump sections (lines 4000-4110 and subroutine 30000). These functions are executed by the "INPUT#" and "PRINT#" statements. The phrase "−1" is required in Level II BASIC for multiple cassette deck control.

The series of "PRINT CHR$(10)" statements in subroutine 20000 execute the ASCII control code for "line feed/carriage return." The same result can be obtained by using separate PRINT statements for each string.

Finally, lines 4280-4310 are keyed to a separate but related program which automatically computes monthly traffic statistics from the data file. There is no effect on the resident program and the inputs are easily bypassed.

Whether you are presently handling a lot of traffic, a little traffic, or are now tempted to try traffic handling for the first time, I think you will find this program to be valuable and fun to work with.■

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✓See List of Advertisers on page 130

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

FLEMINGTON NJ
APR 3

The annual Flemington NJ Hamfest will be held on Saturday, April 3, 1982, from 8:30 am to 3:30 pm at the Hunterdon Central High School Field House, Flemington NJ, located between New York City and Philadelphia at the intersection of Rtes. 202 and 31, just 10 miles south of I-78. Admission is a $3.00 donation. There will be a flea market with a large heated indoor area, 200 tables, major manufacturers, and more. Talk-in on 146.52, 147.015, 224.12, and 224.54. For reservations or further information, call (201)-788-4080, or write Cherryville Repeater Association, c/o W2FCW, Box 76, Farview Drive, Annandale NJ 08801.

MEMPHIS TN
APR 3

The Memphis Mini-Fest will be held on Saturday, April 3, 1982, from 8:00 a.m. to 5:00 p.m. at the Pipkin Building in the Mid South Fairgrounds. Admission is $1.00. Flea market space is $5.00 or 2 spaces for $8.00 (bring your own tables and chairs; none will be furnished). Doors will be open at 6:00 am for unloading. There will be a hospitality party Saturday night at 7:30 p.m. For further details, contact Clayton Elam K4FZJ, President, Mid South Amateur Radio Association, 28 N. Cooper Street, Memphis TN 38104, or phone (901)-274-4418 (days) or (901)-473-6714 (nights).

ROCHESTER MN
APR 3

The Rochester Amateur Radio Club and the Rochester Repeater Society will sponsor the Rochester Area Hamfest on Saturday, April 3, 1982, at John Adams Junior High School, 1525 NW 31 Street, Rochester MN. Doors will open at 8:30 a.m. There will be a large indoor flea market for radio and electronic items, prize raffles, refreshments, and plenty of free parking. Talk-in on 146.22/.88 (WR0AFT). For further information, contact RARC, c/o WB0YEE, 2253 Nordic Ct. NW, Rochester MN 55901.

OAK RIDGE TN
APR 3-4

The Oak Ridge ARC will hold the fourth annual Oak Ridge Hamfest on April 3-4, 1982, at the Civic Center, Oak Ridge TN, from 9:00 am to 5:00 pm. Admission is $3.00 and accompanied children will be admitted free. There will be an indoor dealer display, forums, prizes, concessions, and an outdoor flea market. Talk-in on 146.28/.88, 147.72/.12 (backup), and 146.52. For more information, send an SASE to ORARC Hamfest, Attn: Jim McNair N4EXG, PO Box 291, Oak Ridge TN 37830.

MADISON WI
APR 4

The Madison Area Repeater Association, Inc. (MARA), will hold its tenth annual Madison Swapfest on Sunday, April 4, 1982, at the Dane County Exposition Center Forum Building, Madison WI. Doors will open at 8:00 am for sellers and exhibitors and at 9:00 am for the public. Admission is $2.50 per person in advance and $3.00 at the door. Children twelve and under will be admitted free. Tables are $4.00 each in advance (early reservations are recommended) and $5.00 at the door. Features will include a flea market, commercial exhibitors, and door prizes, as well as an all-you-can-eat pancake breakfast and a bar-b-q lunch. There are hotel accommodations nearby and plenty of parking space. Talk-in on 146.16/.76 WR9ABT. For reservations or more information, write to MARA, PO Box 3403, Madison WI 53704.

GROSSE POINTE MI
APR 4

The Southeastern Michigan Amateur Radio Association (SEMARA) will hold its 24th annual hamfest swap and shop on April 4, 1982, from 8:00 am to 3:00 pm at the Grosse Pointe North High School, Vernier Road (between Mack and Lakeshore), Grosse Pointe MI. The admission charge is $1.00 in advance and $2.00 at the door. There will be good food, plenty of free parking, door prizes, cash prizes, and a grand prize drawing. Talk-in on 147.75/.15. For further information, please send an SASE to SEMARA Swap, PO Box 646, St. Clair Shores MI 48083, or phone Ray Ninness WD8KXN at (313)-777-0119.

FRAMINGHAM MA
APR 4

The Framingham Amateur Radio Association will hold its 6th annual spring flea market on Sunday, April 4, 1982, at the Framingham Police Station drill shed, Framingham MA. Admission is $2.00. Sellers' tables are $8.00 before March 27, and $10.00 after that date. Doors will open at 10:00 am but sellers may begin setting up at 8:30 am. Radio equipment, computer gear, food, and bargains will be available. Talk-in on .75/.15 and .52. For more information, contact Ron Egalka K1YHM, 3 Driscoll Drive, Framingham MA 01701, or phone (617)-877-4520.

SOMERSWORTH NH
APR 17

The Great Bay Radio Association will hold its 2nd annual Hamfest-Flea Market on Saturday, April 17, 1982, from 9:00 am to 3:00 pm at the Somersworth

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RG8U Mil spec 96% shield......$22.95/100 Ft.
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RG8U 96% shield, mil spec......31¢/ft.
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RG8U 80% shield......18¢/ft.
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5685 SW 80th. Street Dept. RLO Miami, Fl. 33143 Call (305) 661-5534 ✓412

Come See Us At The Dayton Hamvention

Armory, Somersworth NH. The entrance fee is $1.00 per person and the ticket counts toward door prizes. There will be antique radios and computers on display, hourly door prizes, and a grand raffle for a Radio Shack color computer as well as other prizes. Free parking. Food and refreshments will available. For advance reservations and further information, call Dick Sedgewick N1EX at (603)-742-3703, or write Great Bay Radio Association, Rte. 16, Dover NH 03820.

SCHERERVILLE IN
APR 17

The Lake County Amateur Radio Club will hold its 29th annual Herb S. Brier Memorial Banquet on April 17, 1982, at The Ember's Steak House, 1112 Route 41, Schererville IN. Tickets are $8.50 and can be obtained by writing to PO Box 1909, Gary IN 46409. No tickets will be sold at the door.

WELLESLEY MA
APR 17

The Wellesley Amateur Radio Society will conduct its annual auction on Saturday, April 17, 1982, at the Wellesley High School cafeteria, Rice Street, Wellesley MA. Doors open at 10:00 am. Talk-in on .63/.03, .04/.64, and .52. For further information, contact Kevin P. Kelly WA1YHV, 7 Lawnwood Place, Charlestown MA 02129.

GRAND JUNCTION CO
APR 17

The Grand Mesa Repeater Society will hold the third annual Western Slope Swapfest on Saturday, April 17, 1982, from 10:00 am to 4:00 pm at the Plumbers and Sleamfitters Union Hall, 2384 Highways 6 and 50, Grand Junction CO. Admission is free and swap tables are $5.00. Features will include an auction, door prizes, and refreshments. Talk-in on .22/.82. For further information, send an SASE to Dale Ellis KDØM, 588 Starlight Street, Grand Junction CO 81501, or call (303)-434-5981.

JACKSON MS
APR 17-18

The Jackson Amateur Radio Club will host the ARRL Mississippi State Convention on April 17-18, 1982, at the Raymond Road National Guard Armory, Jackson MS. Admission is free. Hours are noon to 5:00 pm on Saturday and 8:00 am to 2:00 pm on Sunday. Activities include forums, net and special activity group meetings, dealer exhibits, prizes, and flea market. Swap tables are $5.00 each day. Special rates are available at the Holiday Inn Southwest if you specify that you are attending the Jackson hamfest. There will be a hospitality room at the hotel Saturday night and food will be available at the hamfest both days. Talk-in on 146.16/.76, 146.52, and 3987.5. For swap-table reservations or further information, contact Don Elder KC5VD, 2806 N. Mill Street, Jackson MS 39216, or phone (601)-362-0336.

TRENTON NJ
APR 17-18

The 7th Trenton Computer Festival will be held on Saturday and Sunday, April 17-18, 1982, from 10:00 am to 5:00 pm at Trenton State College, Trenton NJ. Admission for all activities is $5.00. Student admission is $3.00. Features will include commercial exhibits, an electronics flea market, many technical sessions, and, on Sunday, free short courses. For further information write TCF-82, Trenton State College, Hillwood Lakes CN550, Trenton NJ 08625, or call (609)-771-2487.

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PADUCAH KY
APR 18

The Paducah Amateur Radio Association Ham/Swap Fest will be held on April 18, 1982, from 9:00 am to 3:00 pm CST at the Paducah Jaycee Civic Center, Paducah KY. Admission is $1.00 and includes a free table. There will be net meetings and a flea market. Talk-in on 147.66/.06. For more information, contact Bruce Huyck WD4BVW, Rte. 8, Box 431, Paducah KY 42001, or phone (502)-444-7725.

SULLIVAN IL
APR 18

The 21st annual Moultrie Amateur Radio Klub Hamfest will be held on April 18, 1982, at the Moultrie County 4-H Center Fairgrounds, Caldwell Road, located 5 miles east of Sullivan IL. There will be a heated indoor flea market and a large, covered, outdoor flea market. There is no charge to vendors and space is on a first come, first served basis. Talk-in on 146.94 and 146.655/.055. For more information, write Ralph Zancha N9CDK, President, MARK, PO Box 55, Lovington IL 61937, or call (217)-873-5287.

RALEIGH NC
APR 18

The Raleigh Amateur Radio Society will hold its 10th annual hamfest on Sunday, April 18, 1982, from 8:00 am to 4:00 pm at the Crabtree Valley Shopping Center parking area, Raleigh NC. Admission is $4.00; there will be a table charge for exhibitors and flea market displays. First prize is a choice of a Kenwood TS-830S transceiver or an Icom IC-251A multi-mode 2m transceiver with a Mirage B108 80-Watt amplifier. A hospitality room and party will be held the preceding evening from 7:00 pm to 10:00 pm. Talk-in on 146.04/146.64 and 146.28/146.88 both days. For more information, please contact Ken Boggs KB4RV, 8704 Cliff Top Ct., Raleigh NC 27612, or phone (919)-782-8646.

DAYTON OH
APR 23

The 13th annual B•A•S•H will be held on Friday night, April 23, 1982, at the Dayton Hamvention at the Convention Center, Main and Fifth Streets, Dayton OH. Admission is free and parking is available in adjacent city garage. Live entertainment, sandwiches, snacks, and a COD bar will be available. Awards will include a new synthesized HT and a synthesized pocket scanner. For further information, contact the Miami Valley FM Association, PO Box 263, Dayton OH 45401.

SPOKANE WA
APR 24

The Inland Empire Amateur Clubs will hold the third annual Inland Empire Swap Fest on April 24, 1982, beginning at 9:00 am at the Spokane Interstate Fairgrounds, Broadway and Havana, Spokane WA. Admission is $1.00 and includes a special door prize raffle ticket. Regular raffle tickets are $.50. Activities include commercial and non-commercial displays, an auction, YL craft sales, a snack bar, a banquet at Roy's Chuckwagon, and a flea market. Tables (4' x 8') are $5.00 per full table and exhibit space is free. Talk-in on 146.34/.94 and 146.52. For reservations for tables, exhibit space, and/or a free RV site (without electrical hookup), write Swap Fest, c/o Jan Thiemann KA7DDV, 78033 E. Mission, Spokane WA 99206.

BEMIDJI MN
APR 24

The Bemidji Amateur Radio Club will hold a swapfest on Saturday, April 24, 1982, starting at 9:00 am at the Holiday Inn, Highway 2 west, Bemidji MN. There will be door prizes, refreshments, and plenty of free parking. For more information, contact Bill Williams WAØABX, Rte. 1, Box 369J-3, Bemidji MN 56601, or phone (218)-751-9070.

DIXON IL
APR 25

The Rock River Amateur Radio Club will hold the 16th annual hamfest on Sunday, April 25, 1982, at the Lee County 4-H Club Center, 1 mile east of the junction of Rtes. 52 and 30, south of Dixon IL. Advance tickets are a $2.00 donation; at the gate a $2.50 donation will be asked. Breakfast will be served from 6:30 am to 9:00 am and lunch will be served from 9:00 am on. The grand prize is $500

cash and the second prize is $200 cash. You need not be present to win these, but you must be present to win the hourly door prizes. Talk-in on 146.52. For advance tickets, write Ed Webb WD9CJB, 618 Orchard, Dixon IL 61021.

BRAINTREE MA
APR 25

The South Shore Amateur Radio Club of Braintree MA will hold an indoor flea market on Sunday, April 25, 1982, at the Viking Club, 410 Quincy Avenue, Braintree MA from 11:00 am to 4:00 pm. An entrance fee of $1.00 will include one chance for the door prizes. Additional chances are 3 for $1.00. Plenty of parking will be available. The Viking Club will be open for vendors at 10:00 am. Eight-foot tables will be available for $8.00 each and may be reserved in advance by sending a check payable to the South Shore Amateur Radio Club to Ed Doherty W1MPT, 236 Wildwood Avenue, Braintree MA 02184. For further information, call Ed at (617)-843-0510 or (617)-843-4431 (evenings).

LYNNFIELD MA
MAY 1

The Quannapowitt Radio Association (QRA) will hold an indoor/outdoor hamfest on Saturday, May 1, 1982, from 9:00 am to 4:00 pm at South Hall Fire Station, corner of Salem and Summer Streets, Lynnfield MA. Admission is $1.00 at the door. Reserved tables are $5.00; at the hamfest, $7.00. Food will be available. Talk-in on 146.19/.79 or .52. For additional details, write Dave Meldrum KA1M1, 28 Cedar Lane, North Andover MA 01845.

HAM HELP

Our club is in dire need of a service manual for a Johnson Thunderbolt linear amplifier, catalog # 240-353.

Ronald Daly WB9ZNI
Hot Springs
Amateur Radio Club
Box 385
Hot Springs SD 57747

I need schematics for the 2-meter Edgecomm mobile radios 25A and 3000A. I will pay copy costs and postage.

Rudolph Fallang KA7DTA
717B SE 6th
College Place WA 99324

I am looking for a DG-5 digital display and a DS-1A dc-dc converter for a Kenwood TS-520S. Please state condition and price, including shipping.

John P. Iorio WD4MWH
5228 Longview Dr.
New Port Richey FL 33552

I am looking for a Vocaline AT-30 420-MHz transceiver. These units are very old, but I am sure that one can be found.

Allen Harris
3047 Worden St.
Muskegon MI 49441

I am in need of a source for stainless spring rod in pieces that are five feet long and no more than 1/8" in diameter. Tapered replacement CB whips are not quite long enough.

Stan Hockman KA4DSK
638 Flager Blvd.
Lake Park FL 33403

Does anyone have issues of "Ham News," published by G.E. for at least six years (1948-1954) or "Ham Tips" published by RCA in the early 1950s? I will copy your originals or pay for duplication.

I am also in need of a Knight T-60 transmitter and a Star Roamer R-55 receiver in any condition.

John C. White WB6BLV
560 North Indiana
Porterville CA 93257

An amateur in the Ivory Coast is looking for a RTTY program and interface to use with the Atari 800 computer. Can anyone help me to help him?

Fred Trick, Sr. KB9UB
Zetfred Company
PO Box 265
North Manchester IN 46962

Wanted: Robot Model 70 SSTV monitor, regardless of condition.

Dante Ventriere KA4JRE
17831 NW 81 Ave.
Hialeah FL 33015

Wanted: amateur radio QSL cards prior to 1930 for old-time display.

Dave Noon VE3IAE
19 Honeysuckle Cr.
London, Ontario
Canada N5Y 4P3

I need a schematic and operating manual for a Knight KG-2100 dc oscilloscope.

Joe Bische KA4HAG
3412 29th St. W.
Bradenton FL 33505

I am looking for a 5AHP7A CRT or the address of a dealer that carries them.

Wayne Robotham
40 Thyra Ave.
Toronto M4G 5G5
Ontario, Canada

I need a system to connect my home with a telephone approximately two miles away. Does anyone know of wireless units that will cover that range?

Alfonso Gallegos
Casilla #3150
Quito, Ecuador

I would like to hear from anyone who has modified an Alda 103 transceiver. I am particularly Interested in adding a digital readout and 10 meters.

J. L. Navarrete WB6MHN
1903 Santa Ysabela
Rowland Heights CA 91748

Purple Heart, a national amateur radio chapter and net of combat wounded veterans, is being formed to affiliate with the Military Order of the Purple Heart, Inc. Eligible veterans are invited to write for information and application.

Clem Harris KC5MM
6110 Pecan Trail Dr.
San Antonio TX 78249
(512)-699-1420

I need complete information on how to make a frequency converter in order to have an SB620 Scanalyzer set at an input of 455 kHz show a display from a Drake TR4CW's 9-MHz i-f.

In order to prevent possible overload, could a very small sample be taken from the i-f and put through an amplifier before coupling to the SB620?

Albertis G. Long KC9JY
620 N. 3rd
Boonville IN 47601

I am trying to complete construction of the add-on capacitance meter described in the February, 1981, issue of *73*. I would appreciate hearing from anyone who has had success with this project.

Tom Reel WB8UDQ
5071 Tahquamenon
Flushing MI 48433

I would like to get a complete history for the Hammarlund HQ-200 receiver. I am looking for the years it was made, modifications, and any specialized service manual as opposed to the regular operational manual. I will pay for copying and postage or copy and return your original.

D'arcy Brownrigg
Chelsea, Quebec
Canada J0X 1N0

I am returning home from Germany to the Rome/Cartersville, Georgia, area. Any job information for a First Class Radiotelephone and amateur Extra class licensee commencing in August would be most appreciated.

B. G. Echols, Jr.
WA2NYR/DA2EJ
University of Maryland
Jaeger Kas., Bldg. 26
APO New York NY 09162

I would like to get a Novice license. Are there any nearby hams that could help me on my days off? An hour every other weekend would be a great help.

Robert Good
Box 86
Overbrook KS 66524
(913)-665-7483

I need a service manual and schematic diagram for a Motorola T41GGV series "Twin V" transceiver. I will pay reasonable copying costs or copy and return.

Jeffrey Miller WD4SMA
2112 Natahoa Court
Falls Church VA 22043

I am looking for manuals and specification sheets for Hallicrafters SX101 and SX42 receivers. I will buy your originals or pay for copying.

Bob Allie
736 Pine St.
Central Falls RI 02863

Flash and Crash 101

—how to weather the storm

Dave Malley K1NYK
132 Lydall
Manchester CT 06040

Lightning is one of the most common occurrences found in nature and certainly tends toward the spectacular. It is responsible for starting about 10,000 wilderness fires in this country each year and also infrequently causes deaths. Furthermore, there have been many misconceptions and superstitions invented over the years.

In spite of the losses that can be involved, the average person knows very little about this phenomenon. It would seem that hams in particular have something of a vested interest in knowing the facts so that the fate of their equipment will not be left completely up to chance. This article will deal both with how lightning occurs and the various protection methods that are available.

A lot of information has been obtained since Ben Franklin first tried to electrocute himself with his experiments about 200 years ago. Meteorological observations now have established thunderstorm activity levels on a worldwide basis. Fig. 1 shows that the annual number of these storms varies from single-digit numbers up to as high as 200 in parts of South America. Interestingly, the maximum activity occurs over land masses that are located close to the equator. This relationship to latitude mostly reflects increased evaporation and cloud formation in the hotter climates.

Similar data has been generated for thunderstorm frequencies encountered across the United States. South Florida has the distinction of having the highest annual activity—100 thunderstorm days. Fig. 2 shows the thunderstorm activity throughout our country and can be used as a partial guide for determining the typical frequency in your area.

The information presented in Figs. 1 and 2 shows the number of days that thunder was heard and does not tell whether a lightning flash goes to ground or is contained inside the cloud. Furthermore, the number of flashes to ground increases substantially with increasing distance *away* from the equator (Fig. 3). Severity of storms is not reflected by the data at all. (A more precise method might involve recording thunderstorm duration instead of just occurrence.) Consequently, these activity levels should be considered as relative information rather than absolute values.

The clouds that typically are responsible for thunderstorms and lightning are termed cumulonimbus. These so-called "thunderheads" are usually very large and reach overall heights of 35,000 feet. The temperature at the top of the cloud is a rather brisk −40° F. Such a cloud formation will spread out horizontally over several miles. Lest you think that lightning is produced only by thunderstorms, you might be interested to know that sever-

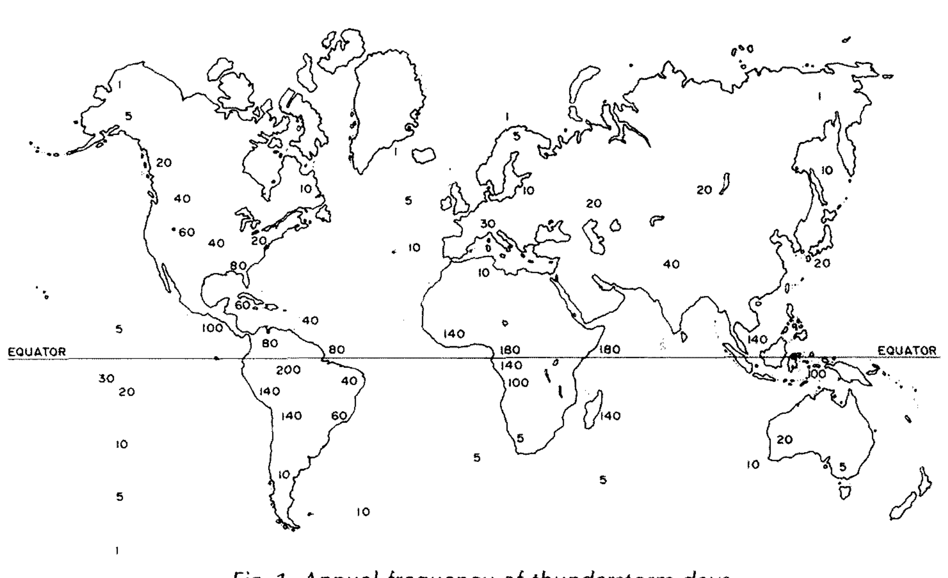

Fig. 1. Annual frequency of thunderstorm days.

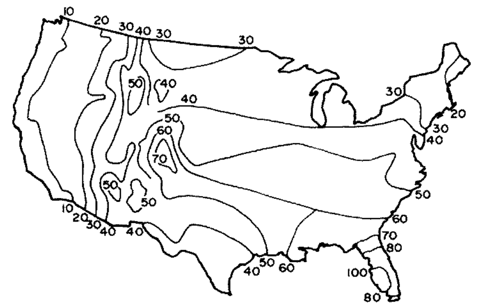

Fig. 2. Typical annual US frequency of thunderstorm days (Ref. 1).

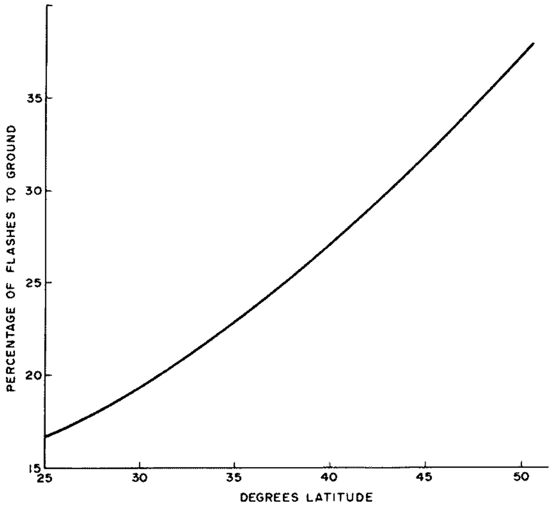

Fig. 3. Graph shows increasing probability of cloud-to-ground lightning strikes as distance from equator increases.

al other possibilities exist as well. These include: sandstorms, snowstorms, and clouds located over erupting volcanos (Reference 1). Lightning associated with snowstorms occurs often enough to be a concern to aircraft. Back on the ground, though, we will be interested in the common thunderstorms.

Contrary to widespread belief, lightning does not come instantly crashing down to the Earth whenever Zeus is angry. In fact, it does not always come *down*, but occasionally can extend up to the cloud. These items are in the folklore that we'll try to set straight. Lightning actually consists of several stages. These are: the leader, initial return stroke, residual decay current, and usually one or more restrikes (Reference 2). The high-current portion occurs in about 10-100 microseconds while the total cycle takes up to 0.25 seconds. The rate of propagation is something less than the speed of light because of inductance and capacitance effects along the path.

The source of energy that ultimately creates the discharge is presumed to be warm air rising toward the top of the cloud. The charging process in the cloud is thought to happen as a result of falling ice crystals. Portions of these crystals splinter off and become electrostatically charged. Wind currents then carry these positive charges up to the cloud's ceiling. The heavier remaining portions of the ice accumulate a negative charge at the bottom of the cloud.

Other theories also exist, but their common denominator is that the cloud contains one or more localized "cells" where the lower part of the cell is negative. Local potential differences can reach many millions of volts inside the cells. Relative to the Earth, the cell (cloud) has a net negative potential and a lifetime on the order of a half hour.

As the cloud comes overhead, the ground underneath it takes on a positive charge. Put more accurately, negative ions in the ground are repelled from the area directly under the cloud formation. When a vertical conductor (flagpole, tower, etc.) is present, an intense field concentration occurs at its tip which can exceed the breakdown (dielectric) strength of the air. This causes microampere "point-discharge" currents characterized by a bluish corona. Sailers used to call this corona St. Elmo's fire after a Mediterranean patron saint. Incidentally, this effect will cause severe local static. This is one reason why vertical antennas have a ball rather than a point at their tip. The ball's larger radius tends to reduce the possibility of corona discharges and their effects on reception.

Eventually, a column of ionized air called a pilot streamer reaches out from the cloud toward the ground. Afterwards, a more intense discharge takes place in the form of a series of incremental steps. This is referred to as the step-leader. This leader and its branches bring the negative cloud potential closer to the Earth—reduce the spark gap, if you will.

Earlier, it was noted that leaders occasionally start from the ground and nearly reach up to the cloud. Fig. 4 shows that fewer than 5% of the leaders associated with a 100-foot tower will behave like this. In all lightning discharges, however, short streamers extend upward from the object just before the discharge. This is the same phenomenon as St. Elmo's fire. When the two streamers connect, they provide a highly conducting path (filament) which allows the charge in the tip of the leader to flow to the ground.

As this current becomes higher, the filament impedance is reduced and more current flows. This reduces the charge at the leader's tip, allowing the conducting arc to reach higher up into the filament channel. Consequently, this arc propagates *up* to the cloud and is called the return stroke. The speed of this return stroke is much faster than the step-leader that was "feeling" its way down to Earth. However, the overall speed of propagation is only about one-third that of the speed of light.

Generally, people are not aware of this return stroke. However, this is what actually produces the bright lightning flash as well as the thunder. The light involved is simply a result of the arc itself, while the high currents result in rapid expansion of the surrounding air. This causes the thunderclap. An old rule of thumb says that your distance from the spot where the lightning struck, measured in miles, is equal to the number of seconds between the flash and the thunder.

The currents flowing during the return stroke average about 25,000 Amperes. Currents above 150k Amps have been recorded, but those over 80,000 Amps are rare. By comparison, the step-leader currents typically are in the tens or hundreds of Amperes. The high-current values are measured indirectly as you

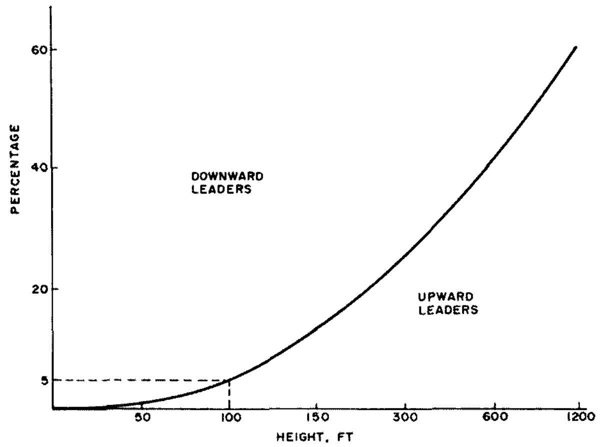

Fig. 4. Percentage of upward leaders is slight without very tall structures.

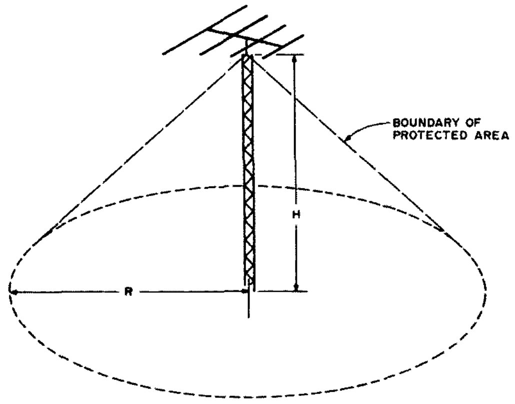

Fig. 5. Sketch showing principle of protective cone where the radius (R) at protective area (dotted) is equal to the tower height (H).

might imagine. Originally, small bundles of steel strips called magnetic links were placed perpendicularly near whatever was expected to be hit. Any eventual lightning current would magnetize the links, and the amount and direction of the current flow could be deduced. Recently, similar methods have used magnetic recording tape where the strike partially erases a pre-recorded signal of known strength. Again, the current would then be calculated.

The final phase in the overall lightning process consists of a low-level continuing current which provides the opportunity for at least one more immediate restrike. This usually happens about 200 millseconds (0.200 sec.) after the initial strike. This additional discharge invariably hits the same point on the Earth as its predecessors. This fact alone indicates that lightning can strike the same spot more than once.

Several factors can increase the probability of a building, tower, or whatever being struck. Geographic effects were mentioned earlier. Most of the others are not surprising. The type of terrain is important, with the valleys being struck less often than higher elevations. For a given location, the possibilities increase as the square of the height of objects above ground.

Grounding a tower will help reduce the amount of electrostatic charge present. This can help avoid a strike since the field strength at the top of the tower will be considerably lower, and upward streamers will find it that much harder to form. More important, though, the good ground will allow the current to be safely discharged into the ground.

Another factor is that the tower (or highest object) creates a so-called cone-of-protection which protects. other structures inside this cone. An example of this could be your house. The actual area protected is not well established, although a conservative figure seems to be that the radius of the cone is equal to the tower height (Fig. 5).

There are quite a number of ways to increase the protection of your equipment during a thunderstorm without going broke in the process. However, you should realize that there is no absolute protection short of tossing all transmission lines, rotor cables, etc., out of the window and unplugging the radio. (Even this assumes that you thought to take action well ahead of the storm and were at home to do so. Do not disconnect these cables just before the storm or when it is in progress.) Fortunately, there are some things that can be done that don't require you to be a recluse in the house.

The first major step is to provide all of the station equipment with a good earth ground. This means that all equipment in the house should be attached (bonded) to an outside ground rod using as short a length of heavy wire as possible. The standard rod is a 0.5-inch copper bar driven eight feet into the ground. This provides a low-impedance path. Experiments have shown that larger diameters or greater depths do not provide better performance. These rods can be bought from local electrical supply houses.

You should avoid copper-plated steel bars because the plating will wear or corrode off leaving a rusty ground rod. There goes any low impedance! Simply check your ground rod to make sure it is not magnetic. If it is really necessary to ground to a water pipe in the house, use a cold water pipe since corrosion can break the electrical continuity of the hot water ones. Also, check to see that the water meter has been bridged with a heavy wire.

At least two of the tower legs should be attached to individual ground rods. These should be driven into the ground rather than through the concrete and into the ground. The same store that carries the rods usually also will stock brass clamps to secure the wires to the tower and the ground stakes. Remember to similarly treat any guy wires. Copper is best for the ground wires, but if aluminum is used, it should be about a #2 size. Don't run aluminum through the concrete since corrosion will ruin the wire in short order.

The wires to each rod should be short and as direct as possible with no kinks or sharp bends. Lightning does not want to turn corners! No ground wire should be placed through a metal conduit. This setup would act as an rf choke and encourage the lightning to find an alternate route. If you are compelled to be neat, use porcelain or some other non-metallic material for the pass-through.

Methods also are available to reduce the risks of strikes to antennas. Again, bleeding off electrostatic-charge buildups caused by rain and snow is helpful. Some antennas such as ground-mounted verticals and beta-matched beams

are already at ground potential and require no further attention in this regard. If this is not the case and coaxial feedlines are used, a device such as Cushcraft's Blitz-Bug can be inserted in the coax near ground level where its case can be grounded. This device contains a built-in spark gap that will bleed off excess charges to ground.

There are other tricks that can be used with coax, also. I made several one-foot diameter turns in the coax at the base of the tower. This took up excess cable lengths and also provided an rf choke to help discourage the lightning from entering the house. A right-angle turn right after the choke arrangement performs similarly. Compared to your transceiver, the price of new coax is cheap!

When the station is not being used, the antenna switch should be turned to its ground position. Since extended inactivity periods occur with vacations, etc., it is convenient to homebrew a coax grounding box which is mounted to the tower or to a ground stake. Such a device is shown in Fig. 6.

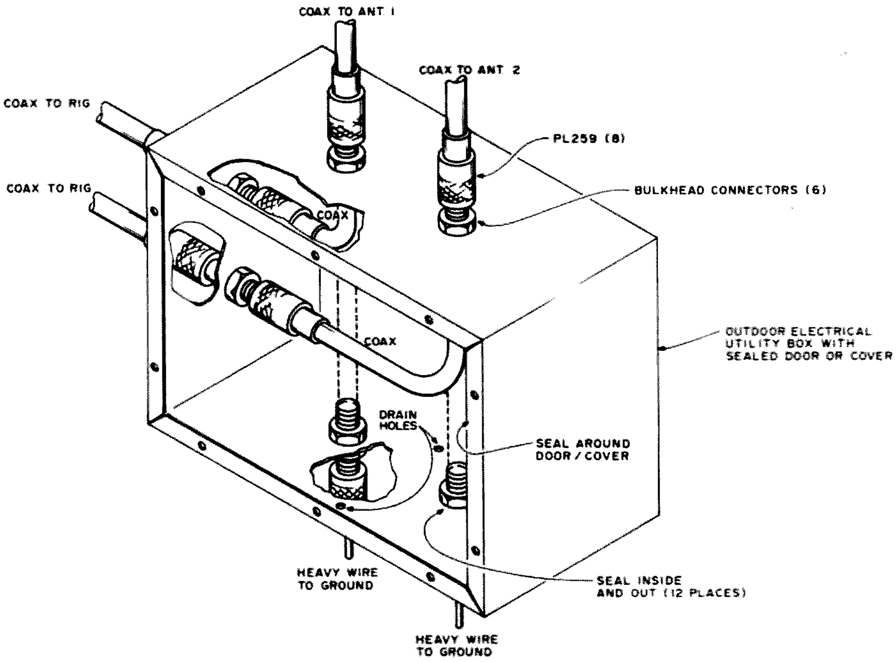

Fig. 6. Sketch showing grounding box configuration for coaxially-fed antennas.

An outdoor utility box with a hinged or removable cover and a good weather-tight seal forms the basis of the unit. Three male-male coaxial feedthrough connectors (UG363) are needed for each coaxially-fed antenna. Inside the box there is a short length of coax with PL-259 connectors attached to each end. One of the groups of three feedthough (bulkhead) connectors is located in the bottom of the box and its center conductor is grounded.

During normal use, a patch cord is connected directly from the antenna to the coax running to the radio. However, before the vacation, this patch cord is changed over to the grounded connector. This grounds the antenna directly and essentially eliminates the chance of a direct hit from entering the house via the coax lines. Remember to be sure to seal the holes around each connector mounted on the box. Silicone rubber, RV, or other compounds can be used effectively for this purpose. It is a good idea to drill one or two small holes (1/16-1/8 inch) in the bottom of the box to allow for condensate drainage.

If your station uses an open-wire transmission line, the above suggestions are not appropriate without some modification. However, this situation was covered long before we started using coax. The time-proven method of protecting gear in this case is to use an air gap (Fig. 7). The gap distance is chosen to be too large for the signal to bridge but small enough to allow lightning to jump across it and continue on to ground. Various handbooks deal with these air gaps in detail, and various things including spark plugs have been used.

In the potpourri department, a comment or two come to mind regarding roof-mounted VHF/UHF antennas and even the TV ones as well. Most people are aware that the mast that supports these antennas should be grounded. A typical installation involves bringing the transmission line, rotor cable, and the ground wire down the side of the house in a neat parallel manner. Electrically, though, it is not so pleasing. In the event of an actual strike, the lightning has a choice of paths to ground. Side flashes from the ground wire to one of the other cables is also possible. This problem can be overcome by making sure that the ground wire is the shortest and placing the other wires away from it. Again, we see the rule of thumb regarding short, direct ground wires coming into play.

One should realize that damage to electronic equipment does not necessarily require a direct lightning strike. Relatively large voltages (spikes) can be in-

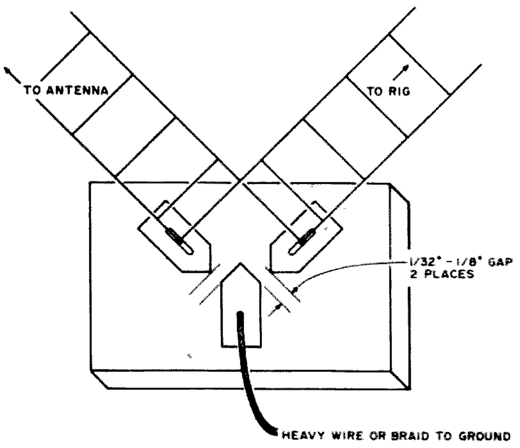

Fig. 7. One of several spark-gap methods used to protect open-wire-fed equipment.

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duced into the ac distribution system when a neighborhood utility pole is hit. The voltage transients produced can travel into equipment via the house wiring. An obvious solution is to pull the plug, but this is not always convenient and can be forgotten. Protection against these spikes is especially important with solid-state rigs since they do not have the overvoltage capabilities of their tube predecessors. Fortunately, help is available in the form of a voltage-spike-protector device. This unit can be attached to essentially any transformer-type ac equipment. The device is a metal-oxide varistor sold by General Electric (Model GE-MOV) and others. The varistor is a two-lead unit that is attached across the transformer primary winding and breaks down to a low resistance in the presence of a large-surge voltage. The action happens very quickly (several microseconds) and shunts the spike across the transformer primary and prevents damage from occuring.

A Closing Note

Well, there you have the basics of how lightning develops and what can be done to minimize its occurrence and effects. Total protection cannot be ensured unless each piece of equipment is isolated from the antenna and the ac mains. Unfortunately, this is not always possible. However, the techniques presented in this article are simple to apply and will provide a significant measure of protection for your equipment. ■

References

1. *Lightning Protection of Aircraft*, NASA publication 1008, F.A. Fisher and J.A. Plumer, 1977.
2. *Lightning Protection*, R.H. Golde, Chemical Publishing, 1973, pp. 9-23.

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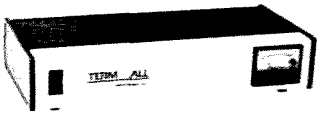

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Stormy Weather

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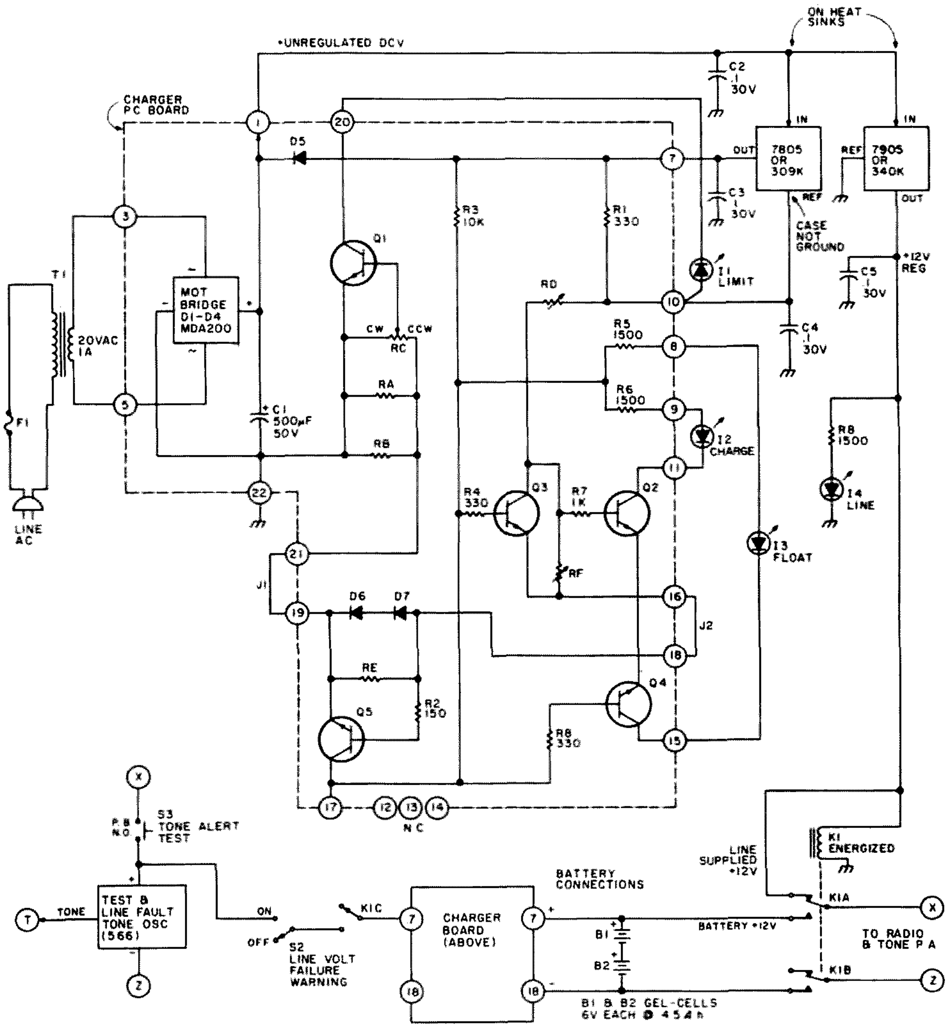

Fig. 1. Power pack: ac operation, dc battery and charging, and the automatic switching between ac and dc.

David J. Brown W9CGI
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Noblesville IN 46060

You say the storm just turned your yard and basement into Lake Michigan? The swing set just tipped over into your picture window, and the St. Bernard got blown halfway through the fence—what's left of it? Is there something going 'round and 'round and marching down your street with your nice new car bouncing along on its top? Is that what's troubling you, Bunky?

The heavens truly opened up and delivered their wrath, but at least you and the family all made it through in one piece! Or maybe you have seen it happen to others, and it just came too close to you for comfort. Well, then, have I got something for you! No longer do you have to keep one eye on the sky, one foot in the basement, one hand on the most valuable thing you own, an ear screwed into the radio, and then still try to work and go around and about your business in that position. That is like the old shoulder to the

wheel, eye on the ball, etc., and-try-to-work-in-that-position joke. Why not let a very special monitor do the worry and watching, courtesy of the National Weather Service VHF radio broadcasts?

Should the "very special" comment lead you to believe my idea is also quite expensive like the special receivers used in schools for weather warnings, don't let it! It is just not true. The "special" refers to the dedicated and reliable job my unit does and some of the easy and inexpensive ways to accomplish really fantastic results.

The Source of Warning

The National Weather Service operates a weather-warning system of VHF stations throughout the country. They are located in nearly every major-size city, near any sizable body of water, and in some remote places you would never believe. A phone call to your local radio/TV station, a note to the National Weather Service (NWS), or punching up their frequency on a monitor will tell you quickly if one is nearby enough for you to use it. The frequencies in use are 162.400, 162.475, and 162.550 MHz, one frequency to any given area.

Our station in the Indianapolis area is on 162.550 MHz and serves a much wider territory of central Indiana than I think even NWS planned on. The transmissions are narrowband FM (approximately 5 to 7 kHz audio) and easily programmed into most of the available monitor/scanners.

A word about scanners, though. I have had Indy NWS programmed into my Bearcat 250 scanner since I first learned of it. I live on a farm, out in the open, and am, in a word, vulnerable! However, if you want the scanner to still scan, you must lock out the NWS channel except when you want to listen to it. Unfortunately, with it locked out, you may miss a weather alert/warning call when you need it most. You could be asleep, scanning 2m or the police, etc. I am not knocking a scanner or monitor for occasional NWS channel use, but to tie one up on it for serious warning and safety use is an expensive and silly approach.

Storms come up far too fast in the southwest and midwest, unlike, say, a hurricane approaching Florida or Texas. There were days of warning on recent hurricanes. In the midwest, when two air masses get together, we often get some hair-raising *minutes* of a tornado warning.

Solutions—Save Our Souls (. . . — — — . . .)

There are, fortunately, several answers to the problem. Proper equipment choice, the way NWS handles real alert conditions, and what you may already have on hand or be able to get cheap are all that I want to tie together in this article.

First, the service was not chosen in the 162-MHz region arbitrarily. It was originally a marine weather service and that fits the frequency range of most of the marine VHF radios nicely. To be useful, it is a 24-hours-a-day, 7-days-a-week continuous broadcast of weather and related information to serve those marine commercial and private boat owner/operators.

Downtime is for fixing a failure or preventative maintenance only, and most stations, if not all by now, have back-up gear to cover those times when the main transmitter is off the air. There is *no* receiving on those frequencies by NWS,

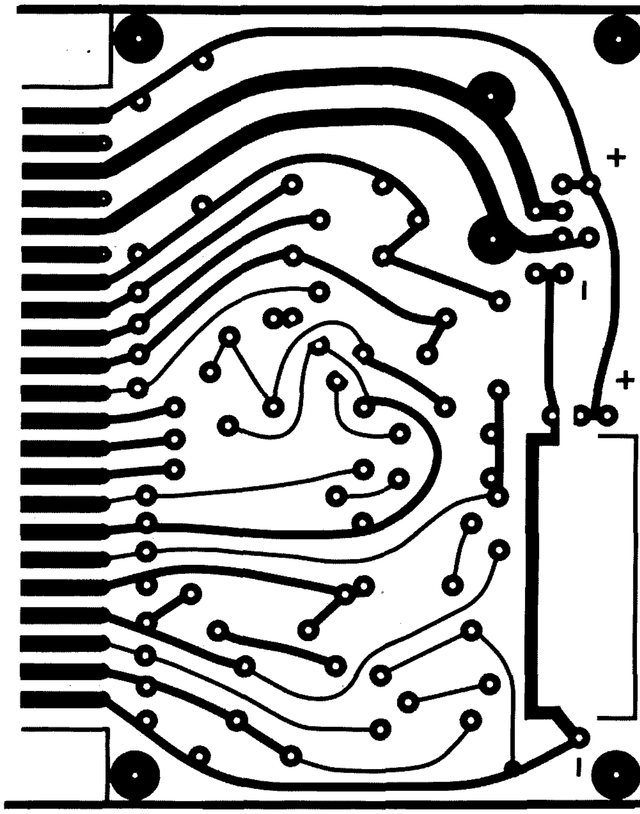


Fig. 2. PC board layout for power source.

and *please* do not transmit anything there! When a real danger exists in the station's area or approaching it, such as severe storms or a tornado watch or warning, the NWS station comes on with a live broadcast immediately.

These "alert" broadcasts are preceded by 15 to 20 seconds of continuous 1050-Hz audio tone. That is the trick to making my receiver idea work, without going insane listening to the all-day and all-night-long broadcasts. They are loop-taped, about 1 minute long, and updated about once per hour or as needed. Over and over, and believe me, it goes on, and on, and on! You could become an NWS announcer word-for-word after about 10 passes of that same information.

Since they use that 1050-Hz tone before every live broadcast of an "alert/warning" nature, I decided to detect it, open a receiver's audio and find out what all the commotion was about, and still not turn into a babbling idiot! So can you, and very inexpensively these days. I have shown and will explain in detail several ways to go about doing this from several different approaches. Then you can have your very own protection and enjoy a valuable and free service. This is not like snitching the HBO or cable services. NWS *wants* you to use this service. You could end up saving property damage to yourself and others, lessen personal injuries caused by these storms, and quite realistically protect life itself—and it could be your own. An ounce of prevention—a minute of warning—same story!

Power Sources

I have outlined a way to

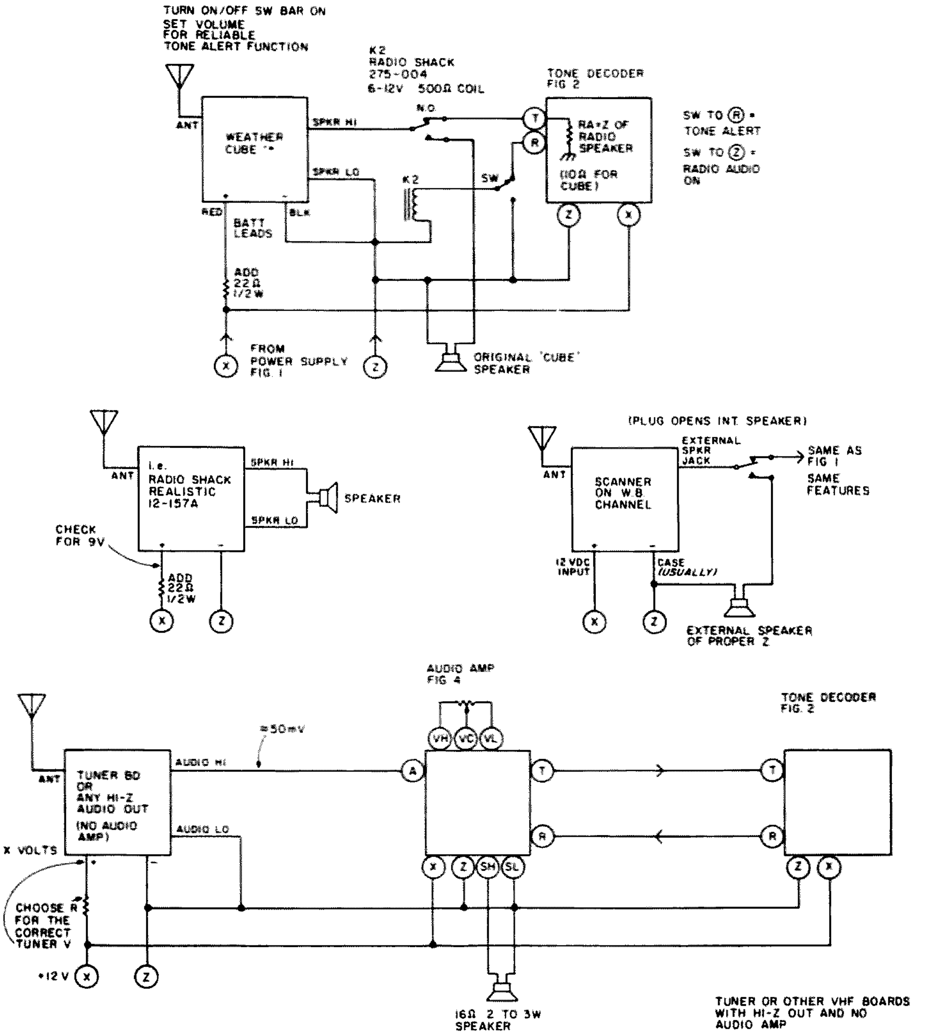


Fig. 3. Configurations: What can be put into service, uses, facts, and ideas. Configuration 1: Low-Z (speaker) radio audio, tone-alert feature, and power line failure feature. Configuration 2: Low-Z (speaker) radio audio, tone-alert built into radio, and power line failure feature. Configuration 3: Scanner use, e.g., Bearcat 101 or 250. Configuration 4: Tuner or other VHF boards with high-Z out and no audio amp. Configuration 5: Can be used like configurations 1 or 3 with 2m FM rig to monitor for tone calls only. Configuration 6: Same as 5, only WWV Time-cube and the tones given on the hour/half-hour/minute for contest or schedule operations. Configuration 7: Same as 5, with converted CB radio on 10m for local net or rag-chew call-up or messages. Configuration 8: Same as 5, with unconverted CB and emergency call-up, e.g., REACT, WTHR, disaster.

be warned of danger, but the danger is storms and with that goes wind, hail, ice, snow, tornadoes—and sooner or later loss of power from the ac mains. If lightning knocks a pole down up the road and your power goes off at the leading edge of the storm, and *then* the tornado comes dancing up to your doorstep, the alert monitor is not going to warn anybody with the juice off!

Any really useful monitor *must* have a standby power source and switch to it automatically. It should use rechargeable, rugged, sealed batteries like those I have shown as Gel/Cells in Fig. 1, B1 and B2. This figure describes my power system and the switching needed. I admittedly overkilled when it came to the Amp-hour rating and capacity of the batteries I used. I wanted to be sure if the power went off in the early evening, without having to forever eagle-eye the monitor, it would continue running on batteries—for days if need be. Further, a 12-volt jack on the back connected across (x) and (z) allows me to run the Bearcat 250 on 12 V dc all the time, by using the Bearcat mobile power input connection. In a real bind, I can even plug in my HW-202 2m FM rig with rubber ducky for full 2m operation. Note: The regulator supplying point (x) will *not* supply the Heathkit 2-Ampere transmit load when the power source is operational in ac mode, but then I have a Heathkit ac power pack for that. I am referring to real emergency conditions and battery operation only. The source in ac mode (point x) will supply 1 Ampere maximum.

In order to get the project into use as quickly as possible, I have "borrowed" heavily on others' designs that I knew worked. I have added a PC board if they did not, modified some circuits to do my bidding instead of the original author's, and created a lash-up that works and works well. I will try to credit the original authors and sources as I come to them, and I will point out my changes.

For opening credits, the battery charger complete with a very nice floating charge system for always live batteries is courtesy of Don Johnson WB6MXD via *73 Magazine*, August, 1980. I have had my alert monitor system for some time now, but the change to Don's system with float feature has really added dimension to it. It made good sense and worked right off, but it had no PC board. I added that as a plug-in or wire-in PC board and it is Fig. 2.

The batteries, as I said, are much more capable than the monitor requires. There is another good reason for staying with all that "grunt" capability, and that is that the batteries are readily available in the form of the replacement batteries for portable TV sets. One such source is RCA dealers or their Parts and Accessories Department (RCA part number 1437888-501—one 6-volt pack, i.e., B1 or B2). 12 volts requires two of these packs.

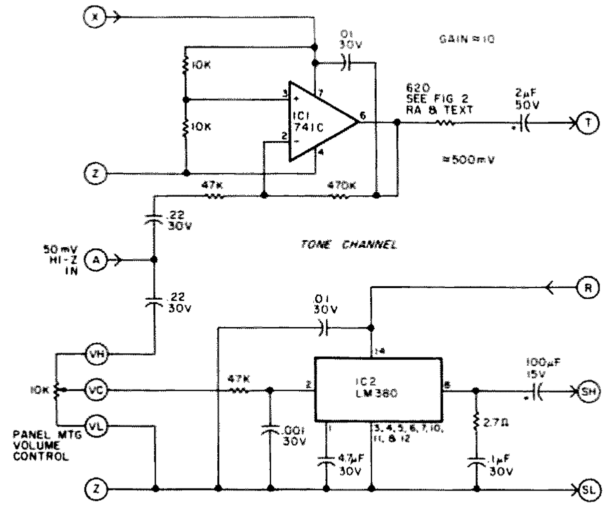


Fig. 4. Audio amplifiers: Using the total unit with tuners that have high-Z audio available and/or no audio output stage(s) to boost audio level for speaker.

It is a plastic package containing 3 cells, has leads of about 6" coming out with a rather standard molex™ 2-pin connector termination (male plugs, female pins), and the leads are long enough to change to any connector of your choice. For information sake, they are made by Gates Battery so their brand name 6 V @ 4.5 Ah will do fine also. The Globe-Union #1245 also is the same.

Control and Switching

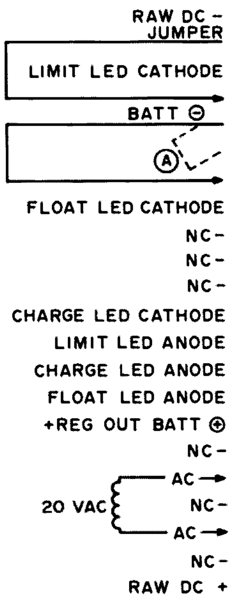
Fig. 1 shows all the switching to automatically drop the monitor to battery upon an ac line failure, sound a 1050-Hz tone and bring up the NWS audio if desired, and even automatically switch back to the ac mains when power has been restored. At that time the batteries begin recharging, and when back up to full charge, switch to the floating charge state to maintain full capacity for the next downtime failure.

LED indicators keep you constantly aware of status, so I recommend you mount them on the front panel with the speaker and volume control. The NWS-ON/Alert position switch can go there or on the rear panel, as you choose. After the tone brings up receiver audio for a fixed period, to go on listening, that switch must be changed from the normal alert monitor position to NWS, so act accordingly with your layout. My LED recommendations are: red for I1 to show limit current, yellow or amber for I2 to show normal charging, green for I3 to show the float/standby condition, and whatever fourth color you can come up with for the remaining I4 to show that the monitor is on and in the ac mode.

All circuits (LED, relay, audio, etc.) are arranged to allow minimum current drain in the battery service mode, i.e., all LEDs are off, relay K1 is de-energized, and audio is off until alert tone is received unless in NWS position. I have changed very little of Fig. 1 from Don's original except the added 12-V dc regulator as an ac-mode power source and switching relay K1. If you do not want the tone warning on ac failure but only for the radio to go on quietly monitoring NWS on battery power, K1 can be just a DPDT relay with a 12-V dc coil, no K1c contacts, and K1a and K1b contacts rated at 1 Ampere. S2 (warning on/off) can then be eliminated. I would advise you to wire it in and just put it to "off"; adding it costs so little. You won't know how useful it is until you have tried it for awhile. In any case, keep the alert test switch, S3, as you still want to be able to test the tone-alert system from time to time with an internal 1050-Hz tone. 20 seconds or so on S3 should open up receiver audio, whether the NWS carrier is present or not.

Automation—The Tone Decoder

This circuit is also borrowed, though modified, and belongs to Robert Lloyd, from *Popular Electronics*, May, 1976 (I read 'em all!). The original cir-



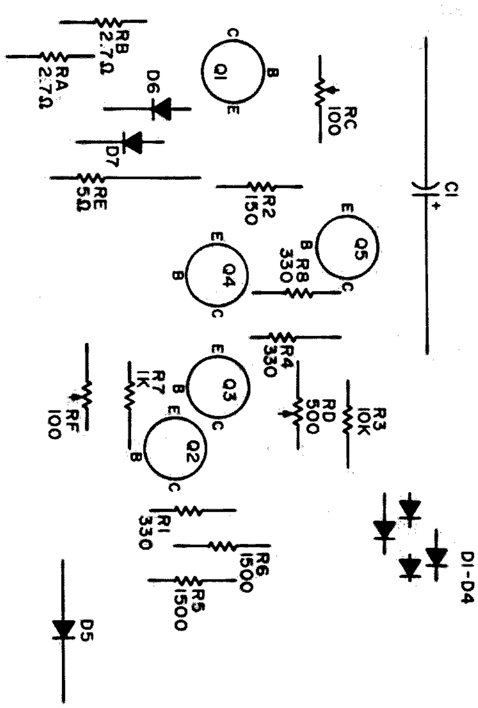


Fig. 5. Component location for power supply board.

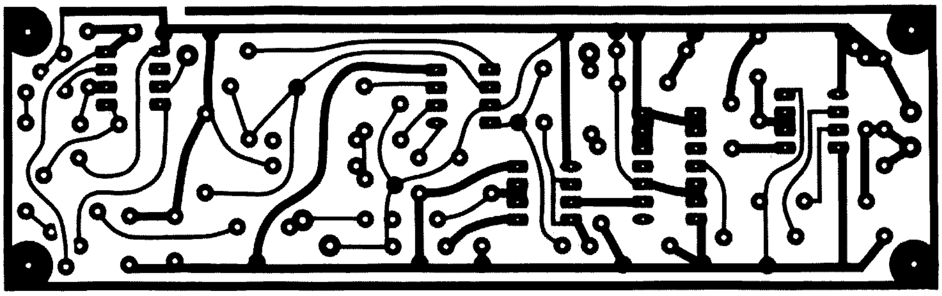


Fig. 6. PC board layout for tone decoder/tone oscillator.

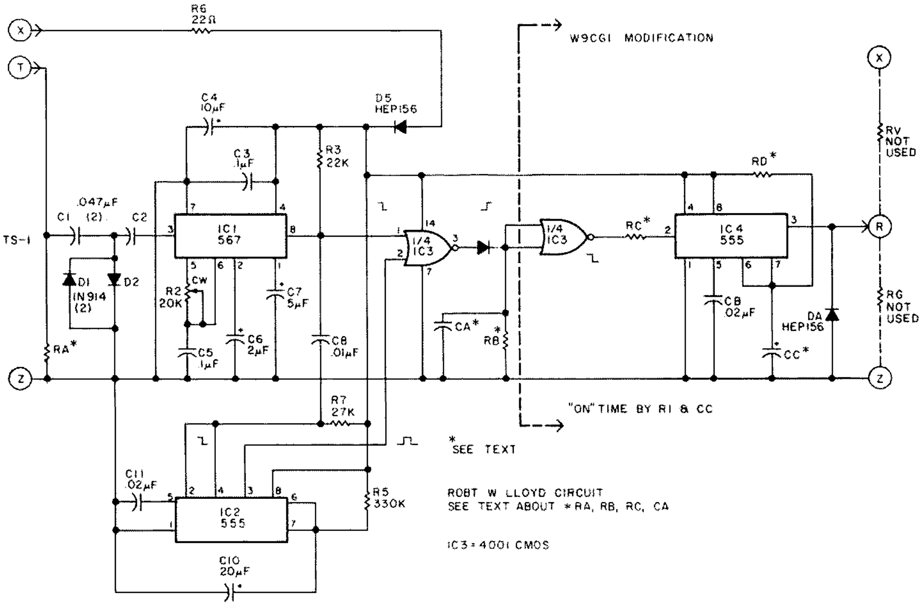


Fig. 7. Tone decoder and latch: Detecting the National Weather Service alert tone and holding audio on for a fixed period.

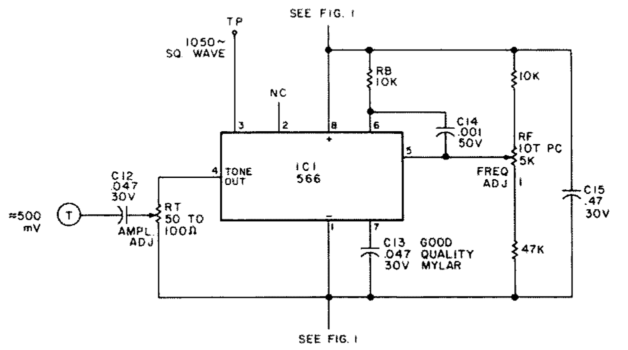


Fig. 8. Tone oscillator: Testing the tone alert and tone source for alerting the user of an ac failure.

cuit ran a 567 IC as the tone decoder, a 555 IC as an anti-falsing device to keep voice in the 1050-Hz range from triggering the monitor audio on, and ¼ of a CMOS 4001 gate to identify the legitimate over-15-second tone by gating the tone decode output (low) and the 555 output (returning to low) to form a high output. Mine is the same up to this point, except Ra is shown as an (*). For the Weather-cube™ used with Lloyd's original circuit (Fig. 3, Configuration 1), Ra is 10 Ohms. You will see more in the rest of the configurations for Ra values, but in general, Ra should be equal to the radio's speaker impedance or close to it. Usually from 10 to 47 Ohms works just fine, but try to match speaker Z. If Fig. 4 is used in any configuration, then Ra should be 600 to 620 Ohms to match the tone preamp's output impedance. There was no PC layout with the original on this one either, so I have included mine as Fig. 6. Fig. 6 also has the tone oscillator on it, since one feeds the other anyway, and that makes one less wire for you to hook up.

The modifications did *not* come about from Lloyd's circuit not working— it does. I simply could not locate quickly enough the HEP 320 SCR he used to latch things on after the tone is decoded. My substitutes were not reliable enough, and while mumbling something about local parts suppliers' relationships to the old 4-legged Army pack transportation, I decided I needed one more feature not provided for in his original circuit. Even had I gotten everything working up to here, I had overlooked one small detail in the NWS signal format and schedule.

Remember, I wanted *total* hands-off operation until the real tone alert brought things up. Well, as an added service to the schools and other NWS users, NWS also sends out a *test* tone callup every morning around 10 or 11 o'clock! That meant my perfect system would come on every morning and "serenade" my wife for 8 solid hours until I got home around 6 pm. You know by now, that even if she unplugged it, it would harp on and on. Since I don't wear a hat, my head goes in the door first, and I have grown rather fond of it staying attached to the rest of my body. 'Nuff said!

Building It My Way

Instead of the SCR to latch the system on, I have used another 555 IC set for about 2 minutes. I used another of the 3/4-unused gates in the 4001 to invert the original high-going SCR turn-on pulse to a low-going 555 trigger pulse. Now the monitor comes on for about 2 minutes. If anything interesting is going on, I can throw the switch from alert to NWS-ON and listen for any period of time, returning it to alert when I have finished. This way, even the test alerts only bring the monitor on for 2 minutes, and that I deemed tolerable. My head was safe again!

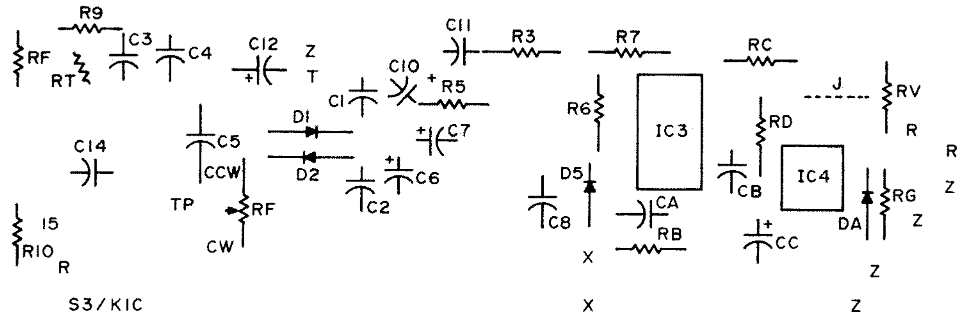


Fig. 9. Component location for tone decoder/tone oscillator board.

As for the further "see text" items indicated by *, Rc can be from 10k to 1M and still trigger the 555 and not injure the trigger input. It is a safety device to protect the 555 trigger input from attaching directly to the +V rail when high, as the CMOS 4001 device would allow it to do. Keep going up to 1M (or it quits triggering), cut that value in half, and you should be in fine shape from both safety and reliability standpoints.

Ca can be about the original 0.1 uF/30 V, and Rb should start at the original 470 point. Rb and Ca filter out the little glitch that occurs when the 567 tone decoder output goes low on tone. That low causes the 555 anti-falsing device output to go high, but not immediately. That instant that the 567 and 555 outputs are both low would make gate 1 output high, gate 2 output (inverter) low, and falsely trigger the last latch 555 on—a no-no. As long as the filter is big enough to stop that false triggering and not exceed the total normal tone duration, it will do. It is not critical, so try what you have.

Testing—The Tone-Osciilator Function

The tone oscillator is also borrowed, straight from a National Semiconductor Data Manual, June, 1973, for a 566 tone-oscillator IC. The PC layout is mine and is just added onto the input end of the decoder board, Fig. 6, as that's where its output goes, anyway. It is turned on by turning the voltage on and off, either by manual test by pushing the switch (Tone Alert Test, S3, Fig. 1), or by the K1c relay contact to alert you of an ac line failure. The switch, S2, between K1c and the tone oscillator merely lets you include the loss-of-mains feature, but not always use it if you so desire. Don't let the voltage on/off control of the oscillator scare you. Under normal circumstances it is not good practice, but it allows easier control switching here. The monitor tone decoder needs 15 or so seconds to respond, and the oscillator will settle down to its 1050-Hz output in much less than that.

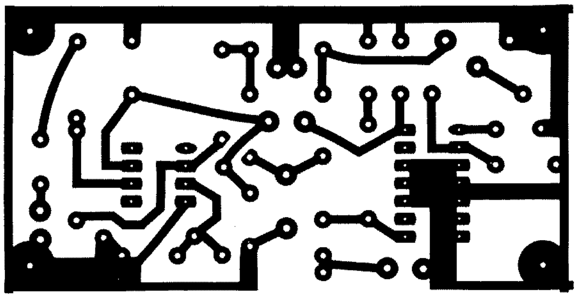


Fig. 10. PC board layout for audio interface.

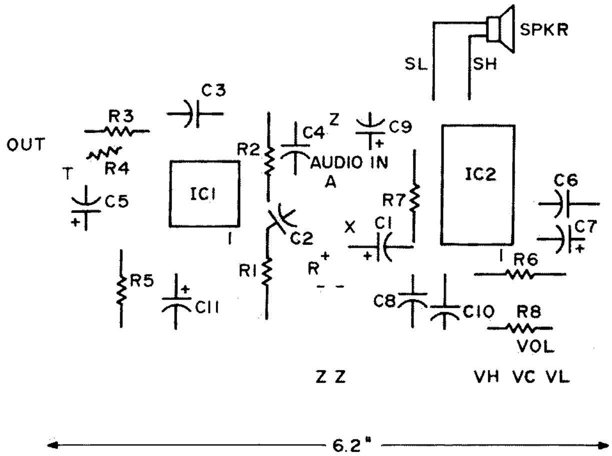


Fig. 11. Component location for audio interface board.

Interface—Making What You Have Work

Fig. 4 is a 2-channel audio circuit, and Fig. 6 is a PC layout for same. It too is "borrowed" from a friend at work, but it is pretty much two data-book circuits on a single PC board. The original intent was to build up the audio from a High-Z source, like a one-IC FM demodulator. One channel (the 741C) builds it up from 50 mV to 500 mV with a 600-Ohm impedance to drive a modulator like that used in a video tape or games unit. The second channel (LM380) builds the power level up to 2 to 3 Watts to drive a speaker. It was ideal for my purpose, and by a minor PC board change to divide the +12-V dc feedpoint into two points, it is perfect. The +12 V dc must go from power source (x) to the (x) of the audio board directly, so the tone amp is always on and working (741C). To silence the audio output without having to resort to things like breaking the poshi lead of the speaker with a relay (see Fig. 3, Configuration 1, relay K2), the +12 V dc to the audio amp (380) is broken instead. This is done by connecting power source (x) to audio board (R). Just when and how this is done is covered in the Configurations section and Fig. 3.

Configurations—Endless Ideas

Obviously, there are many ways to attack the problem once past the highly recommended Fig. 1 power source. The first step is what you are going to use to get the VHF down to audio—the monitor radio part. I have a few tips on that part that can save bucks.

First, don't overlook where you are and where the station is. A nearby station does not take a $300 receiver sensitivity to hear it. Even if you are a bit out from the station, don't overlook using "cropped-down" channel 2 through 6 VHF TV antennas of the discount store variety or a cropped-down broadcast FM or even 2m antenna.

ALIGNMENT and ADJUSTMENT

See the power supply in Fig. 1. With no battery attached, adjust R2 for the floating voltage of 13.5 V dc (2.25 volts/cell × 6 cells = 13.5 volts). Next, adjust the full-charge voltage by jumpering point A to the emitter of Q3 and adjusting R3 for an output voltage of 14.4 V dc (2.4 volts/cell × 6 cells = 14.4 V.

The current limit control, R 4, is a little more difficult to set. I set the control to full counterclockwise, then connected the battery, with an ammeter in series with the battery, to the charger. A partially discharged Gel/Cell will draw in excess of the maximum allowable charge current from an unregulated supply, so all you need to do is turn the limit control until the meter indicates 700 mA.

The charger is ready for service. Connect the Gel/Cell and watch the lights. The yellow LED indicates the battery is charging. If the red LED also is on, you know that the charger is limiting and you can expect the terminal voltage to be below 14.4 volts. As the fully-charged condition nears, the red LED will go out and the voltage will reach 14.4 volts. When full charge is reached (charge current below 100 mA), the yellow LED will go out as the green one comes on.

No alignment or adjustment is required for the audio interface in Fig. 4 beyond setting the user (panel-mounted) volume control for the volume level you want.

See Fig. 7, the tone decoder. For testing, start with the ICs out and the circuit not connected to the receiver.

Install *IC1* in its socket and connect a dc voltmeter between pin 8 and ground (positive side to pin 8). Turn on the dc power and note that the voltmeter indicates close to the supply voltage. Connect an audio signal generator ground to the circuit ground and the hot side to the W terminal of *TS1*. With the relay de-energized, IC1's input should now have a signal.

Set the signal generator as close as possible to 1050 Hz. Adjust *R2* until the voltmeter reading drops to near zero, indicating that *IC1* is decoding. Remove the signal generator and the voltmeter should go back to the supply voltage reading. Perform this step several times to make sure that *IC1* is operating with each application of 1050 Hz. Turn off the audio generator and the dc power.

Remove *IC1* from its socket and install *IC2* in its socket. Connect the dc voltmeter between pin 3 of *IC2* and ground. Turn on the dc power. Connect a jumper to circuit ground and touch the other end to pin 2 of *IC2*. Note that the voltmeter reading is the supply voltage. After about 10 seconds, the voltmeter should drop back to near zero, indicating that *IC2* has timed out. If the timing is too short, increase the value of *R5*. Conversely, if it is too long, reduce the value of *R5*. Check the timing cycle several times to make sure it is in a range of 7 to 14 seconds. Turn off the power supply and remove the jumper.

Remove *IC2* from its socket and install *IC3* in its socket. Connect one end of a jumper to circuit ground and the other end to pins 1 and 2 of *IC3* simultaneously. Relay *K1* should close and lock in. Wait for l4 time-out, and note that the relay opens. Repeat this operation, ending with the relay closed. Remove the jumper and connect it between the supply and either pin 1 or 2 of *IC3*. Remove the jumper and the dc supply.

Once all tests have been made., install all of the ICs. Apply the dc supply and put the 1050-Hz signal from the audio generator on the input. After *IC2* has timed out, the relay should close. Remove the signal input, depress *S1*, and the relay should open and remain open. The circuit is now ready for installation. Note: The tone oscillator if built and frequency-checked for 1050 Hz can be used as an audio generator.

The tone oscillator in Fig. 8 requires only one adjustment to align the frequency adjustment pot for a 1050-Hz output at TP (square wave) or W (triangle wave). Adjust Rt for 50 to 60 mV p-p signal at W, or wait and adjust Rt for consistent tone-alert operation when the decoder is finished and aligned (see Fig. 7 alignment and adjustment information).

They will be fixed-mounted and can even be in the attic if you are not in an aluminum-siding-covered house. The station won't move on you, I promise, so there's no fuss with rotors. Even the "cheapie" monitor radio sounds fine on a good outside antenna instead of its telescoping delight, but try the whip first—it's free with the radio and might amaze you.

As an example, on the Weather-cube from Radio Shack that I had and tried first, indoors and on the whip it sounded OK, but some days it was noisy and some days my tone feature was marginal. That you don't ever want, so just for kicks I lashed it up to my 11-element 2m antenna—unmodified—and the difference was astounding no matter where the antenna was pointed! Not only perfect local copy, but the same on another channel from Chicago 250+ miles away. I merely took a panel-mount screw-in type UHF connector to match the plug on my 2m lead-in with RG-8, soldered a piece of #22 insulated wire to the center pin, wrapped 8 turns (arbitrary) around the base of the collapsed whip (top of radio), and then soldered the remaining end to the ground side of the UHF female. Connect the male from the antenna and voila—signal. Nothing fancy, nothing resonant, perfect copy. Proves if you got it—try it.

In all the configurations I show in Fig. 3, I run the radio off the power source of Fig. 1. In some, that takes a dropping resistor in the + lead to the radio to drop the power source +12 V dc down to the required radio voltage. Most pocket and portable radios of this weather type run off a +9-V dc transistor radio battery. The resistor will be Ohms = 3 volts divided by the radio current in Amps. Wattage of the resistor is 3 volts times the radio current in Amps. Simple Ohm's law. Why, even the appliance operators should not fear this project.

I have shown some various configurations I have tried and listed some possible uses using these lash-ups. The possibilities are as endless as your imagination and time. The examples are specific, but let me generalize a bit.

Configuration 1—This was the original idea: any low-Z speaker output below about 3 Watts, a radio needing about 1/2 Amp or less of +12 V dc or less, and you're in!

Configuration 2—For radios that already have a tone-alert feature, but you still like the standby battery idea.

Configuration 3—Use the idea with a scanner or monitor and decode only net or special calls to be tone type (RTTY?).

Configuration 4—Use a retuned FM tuner, hamfest salvage monitor boards, or 1-to-4-crystal older monitor boards. Buy one crystal—be weather safe! I have seen several of these older monitor boards showing up around the hamfests (Dayton and Indy so far) for $10 or less.

Configuration 5—Same as idea 3 using monitor or scanner.

Configuration 6—Use the time tones of WWV with an inexpensive Timecube™ from Radio Shack. Retune the decoder board to work on the WWV tones you want. Use for contests, 10-minute reminder, etc.

Configuration 7—Use the idea with a converted 11m CB-radio board from one of the flyers (Olson) for use as a local net or ragchew call-up on 10m. The audio outputs are usually missing off these (use Fig. 4), and the transmitter you don't care about for a monitor!

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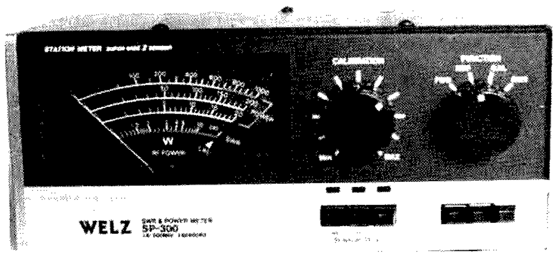

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Configuration 8—Similar to 7, only unconverted CB to monitor CB for REACT channel 9, weather, emergencies.

Configuration 9—I did not show a Configuration 9, but don't over look the possibilities in any of the configurations of added poles on the relays if needed to switch in a tape recorder on those tone call-ups to record a message while you are out. You get a tone call and the caller leaves a message—a nice feature! The recorder can run off the power source just like the radio with an appropriate dropping resistor.

Summary

For the time and money involved, I doubt you could spend a more rewarding weekend of effort. If I were starting from scratch right now and had nothing, I would probably go the Fig. 1 route just for sheer simplicity and lack of cost. The ac power/dc backup is a must. Then go with Fig. 3, Configuration 1. The Radio Shack "CUBE" is a nice little performer for under $20, and it's much less on sale. I have included an Alignment and Adjustment section (see box), and most of these notes are taken right from the original authors' information. I have tried them all, and they work, so I decided to pass them along unchanged. All are of the nature that once done correctly, you can forget them and just enjoy the results. I have not noticed any drift-type problems or anything that would cause a problem when you are counting on the monitor to be working. A very reliable device indeed is what it turned out to be. May your marriage of components and parts be as happy and long lived as mine.■

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REVIEW

THE MICROLOG ACT-1 RTTY/CW TERMINAL

At first glance, the Microlog ACT-1 bears a close resemblance to many other keyboards offered to the amateur RTTY and CW enthusiast. There's a keyboard, a couple of switches and an LED on top, and a bank of connectors on the rear panel. Unassuming? Perhaps, but in reality the ACT-1 serves as a firm reminder that appearances can be misleading.

The Features

The ACT-1 is a completely self-contained unit capable of sending and receiving Morse, Baudot, and ASCII codes. It also can send alphanumeric information in SSTV format. By "self-contained," we mean that a demodulator, AFSK generator, video board, and printer interface are all contained inside the keyboard's cabinet. No other devices are necessary, and a few simple connections are sufficient to put the system on the air.

All commands are entered via the 63-key keyboard. In addition to the usual alphanumeric keys, there are special keys like CTRL, KN, AR, SK, and Here Is. Pressing the CTRL or shift key along with one of the other keys results in a command being generated. CTRL M, for example, switches the unit from the RTTY mode to CW. Almost all commands are entered with just two keys. Listing, much less describing, all that the ACT-1 is capable of would take far more space than is available here, so we'll try to hit only the main points.

There is a dual-tone demodulator and a single-channel direct detector. Both demodulators can be inverted with a keyboard command. The dual-tone demodulator decodes both mark and space tones and has a keyboard-selectable high or low tone setting. The high-tone setting provides a standard 170-Hz shift with tones at 2125 and 2295 Hz and is preceded by a sharp bandpass filter. The low-tone setting is also factory set to 170 Hz, but tones are at 800 and 970 Hz. No bandpass filter is provided for this section.

If you find yourself copying a lot of broadcast services, you can reset the low tone pair easily to a more useful pair, like 425-Hz shift at 2125 and 2550.

The single-channel demodulator copies only the mark frequency and is set to decode at 800 Hz, which corresponds nicely to the peak in many receivers' CW filter. It generally is used for copying stations which are using a shift not programmed into either of the settings for the dual-tone demodulator.

Ease of tuning can be a big factor in the amount of satisfaction a demodulator gives. We have grown rather accustomed to the meter-tuning system used in HAL, Macrotronics, and other equipment, so the single LED used for tuning the ACT-1 took us by surprise. It works very well and is at least as efficient as a meter. Best of all, there is a regeneration circuit that lets the user hear what's being decoded. You simply tune the receiver until the code coming from the ACT-1's speaker sounds right.

Tuning is virtually foolproof in either RTTY or CW modes, and the regeneration should be particularly welcome to hams with impaired vision. Those of us who crave silent operation will be equally pleased to know that the monitor is easily turned off by flicking a switch on the front panel. And if you still insist on using an oscilloscope for tuning, rest assured that outputs are provided for this purpose.

Provision for transmitting with either AFSK or FSK is included. Like most manufacturers, Microlog is partial to the AFSK method, and they advocate its use for a variety of reasons which you may or may not find compelling. For rugged individualists who prefer direct FSK keying, ample information on connecting the ACT-1 to a variety of transceivers is included.

Actually, connection to everything is easy and very well documented in the instruction manual. Much attention has been paid to making the ACT-1 compatible with virtually every rig available. You won't have to haywire any special interfaces to get the ACT-1 on the air.

CW keying is available for both negative- and positive-keyed rigs. The maximum negative keydown rating is -150 V at 50 mA. Positive keying is rated at 40 V at 300 mA.

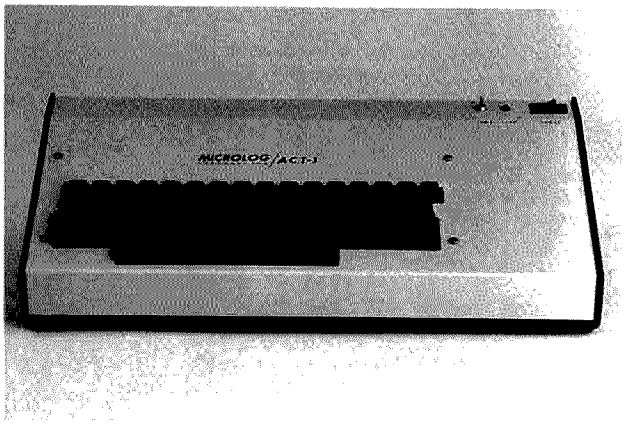
Rear-panel jacks also are provided for a cassette tape recorder, a 40-column serial printer, and an external demodulator. Video output is via a standard photo jack, but since there is plenty of room for a BNC connector, I wonder why one wasn't used.

There is true split-screen operation, allowing the operator to see what he is typing into the buffer while receiving text on the bottom half. The text buffer holds up to 1300 characters, which is certainly respectable. To help customize the system to particular needs, the split line can be set anywhere from none at all to 20 lines down.

When transmitting, the ACT-1 can be set to send as soon as a character has been typed or it can wait until a complete word has been typed. The latter option is convenient because it allows you to catch and correct errors before they go out.

To aid receiving, an ANCW (anti-CW) feature is included, which behaves like the autostart found on other units. When enabled, ANCW inhibits display of non-RTTY signals and is very helpful when tuning across the band reading the mail. The UNOS (unshaft on space) and sync options also behave like similar features on other units. The UNOS shifts the ACT-1 to the LTRS mode on receipt of a Baudot word space code, which prevents the system from getting stuck in the FIGS mode if a burst of interference covers up the command to shift. The sync simply sends a blank code whenever the system is in the transmit mode, but there are no characters to transmit. Both UNOS and sync can be switched off and on from the keyboard.

Baudot speeds of 60, 66, 75, 100, and 132 words per minute, ASCII at 110 and 300 baud, and CW at 5-199 words per minute are available. In the RTTY mode, speeds are selected by typing CTRL X, entering the speed



The Microlog ACT-1. (Photo by KA1LR)

Rear view of the ACT-1. (Photo by KA1LR)

numerically, and then hitting any non-numeric key. This is fine for operators who rarely change speed, but annoying if you are trying to discover what speed a station is using by trying every possibility. Perhaps an option could be added to allow stepping through the speeds by repeatedly pressing a key.

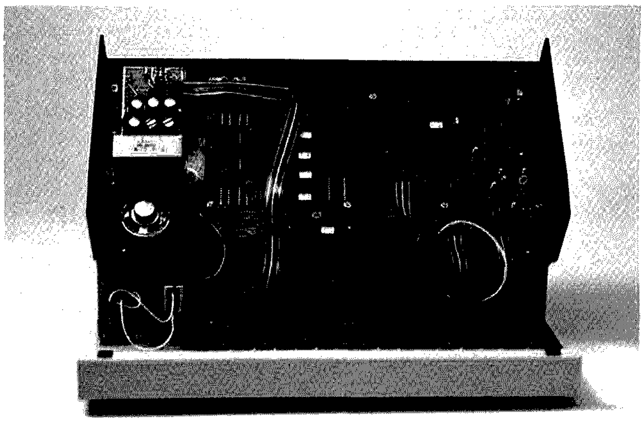
Turning to features which some might term luxuries, there is a real-time clock whose display is always visible at the top of the screen. The time can be transmitted by entering a simple command. The clock must, of course, be reset every time the unit is turned on, but Microlog says that the ACT-1 is designed for continuous-duty operation and never needs to be turned off.

Memories

While the ACT-1's array of memories is not as extensive as that which certain microcomputer interface combination systems offer, there is enough to satisfy most hams' needs. There are two ID memories which hold up to 19 characters each and ten message memories holding up to 40 characters each. The message memories are soft-partitioned, so you can program messages longer than 40 characters if you like. It is possible, for example, to create a single message 400 characters long, but then there won't be room for any other messages.

An eight-character WRU message allows storage of a short code. When the CT-1 receives text that matches the code exactly, it automatically transmits whatever is in the ID memory and then returns to the receive mode. Two selective-print memories allow others to leave a message on your equipment while you are away from the shack. Upon receipt of text that matches the text in the first memory, the printer is activated and hard copy is produced of everything the ACT-1 hears, assuming you have a printer connected. Receipt of text that matches the text in the second memory turns the printer back off. Used together, the WRU and selective-print feature represent a simple but effective means of providing unattended operation.

While not quite as convenient as on-board memory, a reliable interface is provided which allows information to be stored on a cassette tape recorder and



Inside the ACT-1. (Photo by KA1LR)

played back at will. You can record and play back messages entered from the keyboard or copied off the air. Finally, thre are two preprogrammed messages. One sends an RYRY series and the other sends every letter of the alphabet in "quick brown fox..." form.

In Use

Once you have everything figured out (it took us a whole day!), you'll find that the ACT-1 is a powerful tool. You'll find yourself referring to the manual quite often, and it is here that we must voice a small complaint. The instruction manual is one of the best we've seen at describing the steps necessary for interfacing the unit to the rest of the station, but the organization of the how-to-use-it material could stand some improvement. Even the inclusion of a prompt card to be kept on the operating table could make a big difference. With so many commands that don't always use mnemonic devices to aid memory, a prompt card is a must.

Some basic information for beginning RTTY operators also is needed. The manual suggests that beginners get one of the "RTTY-primer handbooks." Since dealers' shelves aren't exactly overflowing with RTTY books, this advice isn't much help to the guy who just got his ACT-1 and wants to put it on the air right away. A short section on RTTY operating procedures really is needed.

We may complain about the manual, but we can't fault the ACT-1's performance. Using it is sheer, unadulterated pleasure! As far as we're concerned, the most important aspect of a self-contained unit is its demodulator, and we've seen some pretty horrible ones. Any reservations we may have had were quickly put aside as we watched the Sanyo monitor display perfect copy from an S-nothing signal buried under SSB splatter, CW, and a couple of other RTTY stations. A remarkable performance. We also enjoyed the variety of shifts that can be copied easily. Broadcast monitoring is great sport, and if you have a general-coverage receiver, you'll want to retune the second filter to 425 Hz immediately.

Operation in the RTTY mode was trouble-free and straightforward. CW operation is as good as anything else we've used—perfect copy from machine-sent code, not-so-perfect copy from the straight key and bug contingent.

Conclusions

Even if you've already decided to use a computer and interface combination for RTTY, the ACT-1 deserves careful consideration. The ACT-1, which has a suggested price of $995, has everything even a serious operator could ask for. Because it is self-contained, it takes up very little room on the operating desk. And even if you are planning to get a computer, a unit like the ACT-1 can free it for more important tasks.

For more information, contact *Micrólog Corporation, 4 Professional Drive, Suite 119, Gaithersburg MD 20879.* Reader Service number 485.

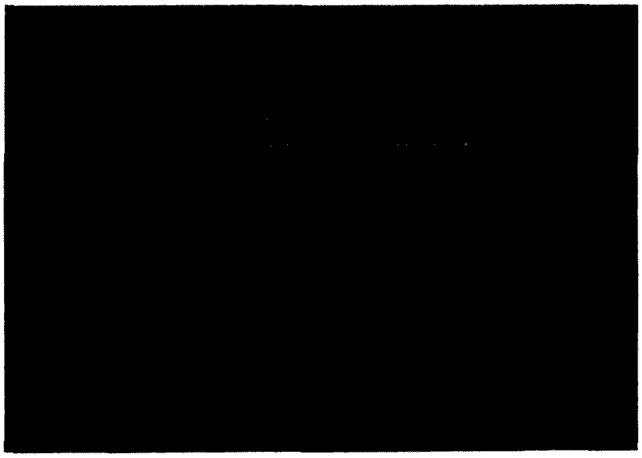
Paul Grupp KA1LR/4
Casselberry FL

THE MFJ-312 VHF CONVERTER

Most of us have wondered at one time or another just what takes place on our VHF public service bands. The scream of a squad car's siren, a black column of smoke on the horizon, or a threatening weather front in the southwest have given many a ham an urge to plunk down hard cash for a synthesized public service band receiver. If the spirit is willing but the pocketbook is not, take courage. MFJ has a clever new converter that allows a standard two-meter receiver to serve as a receiver for that band.

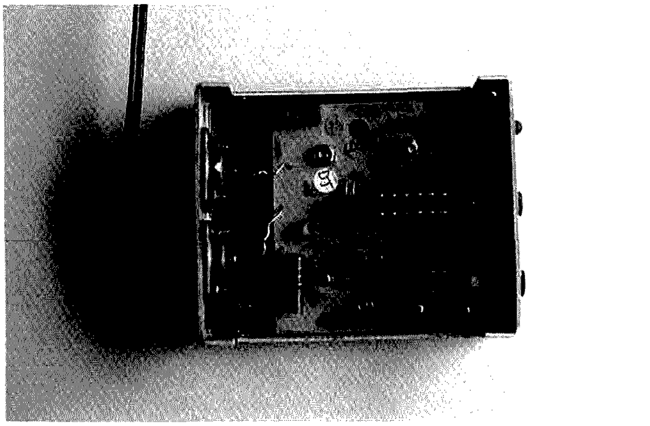
In most installations, the palm-sized MFJ-312 connects to a 12-V-dc power source and a two-meter antenna and transceiver. The converter covers the 160-164-MHz and 154-158-MHz bands, allowing access to police, fire, and NOAA weather transmissions in most areas.

There are only two switches and an LED on the front panel. The left-hand switch selects one of the two bands. The other switches the box in and out of the antenna line and also turns the power on and off.



The MFJ-312. (Photo by KA1LR)

To listen, you merely turn the converter on and tune the two-meter receiver as you would normally. In the 150-154-MHz band, you set the receiver to exactly 10 MHz below the desired frequency. Thus, 154.20 would be heard with the receiver set to 144.20, and 151.335 would be found at 141.335 on your rig's dial. In the 160-164-MHz band, it's a little more challenging—you must set the receiver 16 MHz below desired range. Since the activity in this band is generally limited to a single NOAA weather station, there isn't much of a problem.



The MFJ-312 with top cover removed. (Photo by KA1LR)

In Use

The MFJ-312 performs like a champ. Most listeners won't guess that a converter/receiver combination is being used unless you tell them. The MOSFET mixer and rf amplifier are undoubtedly responsible for the clean, image-free reception. As can be expected, there is a slight increase in noise level when the converter is switched on, but the level never reaches objectionable proportions.

I never tried an antenna cut to 154 MHz, but I suspect that using one might result in an even better performance than I experienced using antennas designed for two meters. For most purposes, a two-meter mobile or base antenna will be more than adequate.

I had a hard time deciding whether to keep the converter in the house or permanently installed in my car. If you contemplate mobile operations, you should be aware that some states and municipalities take a dim view of anyone in a vehicle monitoring the local gendarmes. And even if such activity is perfectly legal in your area, it's healthiest to mount the converter inconspicuously. Don't say I didn't warn you.

Of course, to make the most of this converter, you need a synthesized transceiver. So much the better if you have one with a lot of memories. It's often necessary to bounce between two frequencies to hear both sides of a conversation, so scanning is helpful, too. I used the converter for several months with a KDK transceiver that has two banks of five memories. I used one bank to store public service frequencies and the other for two-meter repeaters. Kenwood, Azden, Yaesu, and others also make transceivers whose scanning capabilities and large number of memories make them ideal for use with the 312.

An interesting feature is the feedthrough of two-meter signals when the converter is switched on. I'm not sure whether this was really intended or not, but MFJ makes the best of it and suggests that you program repeater frequencies amidst the police ones and listen to both even though the converter is switched on. Although signals in the two-meter band are heard with significantly reduced sensitivity in this mode, strong signals come through loud and clear. This is especially useful for those of us who feel obligated to keep an ear open for activity on a certain repeater but don't want to be switching the converter on and off all the time.

This brings up the certainty of accidentally transmitting into the device when it's turned on. MFJ says that the converter is protected against accidental transmissions at power levels up to 25 Watts, but warns that this sort of abuse might be hard on the transmitter's finals. For what it's worth, we pumped 40 Watts into the MFJ-312 for several seconds on many occasions, and neither the transmitter nor the converter complained.

The purists among you are probably wondering what effect if any the converter has on two-meter operations when it's *not* in use. Theoretically, it should have none, since it passes the signal straight through when it is switched out. We noted, however, a slight increase in swr and a corresponding decrease in receiver sensitivity. Emphasis must be placed on the word *slight*. In most areas, the loss either coming or going might not even be noticed. In areas where signals are often less than full-quieting and you need to squeeze every last dB out of your system, you should make provisions for switching the converter out of the circuit when it's not in use.

Conclusions

The MFJ-312 greatly expands one's listening horizons at the very attractive price of $59.95. Using a two-meter rig as the i-f stage makes good sense economically for a ham already equipped with a digital wonder-radio. If you find you enjoy public service listening, the converter will be one of most useful pieces of radio equipment to be had at such a low price. And if you decide that it's really not your cup of tea after all, you'll have the satisfaction of knowing you found out without blowing a week's pay for a scanner!

For more information, contact *MFJ Enterprises, PO Box 494, Mississippi State MS 39762*. Reader Service number 484.

Paul Grupp KA1LR/4
Casselberry FL

EMC GROUNDING BRAID

The Electric Motion Company of Winsted, Connecticut, has introduced a product to end hams' grounding woes. Their flexible copper braid is equivalent to #6 AWG(!) and is well-tinned to reduce corrosion. It appears to provide about 2.5 times the conductor area of RG-8/U braid traditionally used for grounding. Best of all, it is supplied in 25- and 50-foot coils, banishing forever the dubious privilege of stripping braid from coax.

In Use

We have had the opportunity to install EMC's product in several shacks and in each case were impressed with the material. The braid should be brought into the shack from a good grounding point, with attention paid to keeping its length as short as possible. The braid can be run either behind the equipment desk, with separate pieces attached to each piece of gear, or to a central grounding point to which all equipment is connected. Both methods seem to work satisfactorily. Care should be taken to ground everything in your system: keyer, clock, amplifiers, low-pass filters, power supplies, the works. We used short pieces of braid for this purpose and were pleased with how easy it is to cut and handle.

We encountered some problems in making connections to the braid due to its formidable size and the poor connnection points provided on many pieces of radio equipment. One high-power amplifier from a prominent manufacturer appears to have no ground point at all! A low-pass filter we use also has no ground connection point, although the instruction sheet supplied with it emphasizes the importance of providing it with a good ground. Some manufacturers provide their gear with the so-called five-way binding post, which is suitable only for relatively small-diameter wire (inadequate for rf grounding). In these and similar cases (assuming the chassis is supposed to be at ground), you should drill a hole in the chassis and fit it out with a hefty connection point and a couple of large washers.

Because of the braid's size, soldering to it can be difficult. It serves as a very long heat sink! Our 300-Watt iron clearly was not equal to the task. You'll either need to make purely mechanical connections using nuts and bolts or round up a more formidable source of heat than the one we tried!

Conclusions

While there undoubtedly has been suitable braid commercially available somewhere before, it is encouraging to see a manufacturer making it available directly to the amateur market.

For those who insist on having a shack that they *know* is set up properly, the EMC braid is a must. There is simply no longer any excuse for rf burns or TVI caused by poor connection to ground! The material should also be useful for bonding automobile body and chassis components together to reduce RFI.

For more information, contact the *Electric Motion Company, Inc., 100 Whiting Street, PO Box 626, Winsted CT 06098.* Reader Service number 483.

Paul Grupp KA1LR/4
Casselberry FL

TALKMAN C900 PORTABLE TRANSCEIVER

Standard's Talkman.

Exasperated! It's easy to feel that way when confronted with some of the gadgets produced in the name of progress by the personal communications industry. From glow-in-the-dark CB antennas (you don't have one, do you?) to Bone Fones, there have been some real weirdos. Maybe this helps to explain why I took such delight in the Talkman Model C900, the latest in communications gadgetry from Standard Communications. At last! A gadget that's really worthwhile!

The Talkman is a portable FM transceiver which anyone may operate without a license. Most of the circuitry is contained in a small belt pack measuring just 4" x 2.5" x .75" and weighing a mere 9 ounces. An ultralight headset holds a tiny electric mike, earphone, and whip antenna. Despite its diminutive size, however, the Talkman is not a toy, especially at its suggested $129.95 price tag. The Talkman operates on one of several channels available in the 49.830-49.890 MHz range. Since the rig is sold singly, not in pairs, buyers who hope to do any communicating must be careful to obtain units on the same channel. A letter designation on the back of the belt pack indicates the channel.

Technical Features

Most notably, transmit-receive switching is accomplished using VOX circuitry. This makes operating the Talkman a totally hands-free proposition—a real convenience in many situations. Is this use of VOX a first for a communications device intended for the general public?

A straightforward assemblage of 15 transistors and 4 ICs composes the circuitry of the Talkman. The mode is narrowband FM and, in compliance with Part 15 of the FCC regulations, the transmitter output power is less than 100 mW. On receive, a 0.25-uV signal will break the non-adjustable squelch, and a 0.5-uV signal gives 20 dB of quieting. An ordinary 9-V battery powers the unit. Current drain is 13.5 mA squelched, 70 mA while receiving, and 80 mA in transmit.

Controls on the Talkman are minimal, to say the least, with a pair of three-position slide switches doing it all. One switch turns on the unit and allows selection of low or high earphone volume. The second switch is for VOX sensitivity: low, medium, or high. The higher the setting of this control, the more softly you can speak and still trip the VOX. On the other hand, a lower setting helps to prevent ambient noise from actuating the transmitter.

Does It Work?

Yes, it does. In actual use, the Talkman meets or exceeds the claims made by Standard. With the whip antenna completely deployed, the full 1/4-mile range between units is achieved, although signals are not full quieting. Audio quality is on a par with most amateur hand-helds—not high fidelity, but perfectly OK for spoken communications. The headset is extremely lightweight and a pleasure to use, although the placement of the microphone is extremely important for reliable VOX action. My best results were obtained with the foam windscreen almost touching my lips. One complaint about the headset: The mike boom is a little too short for some adults.

Possibilities

Of course, the proximity of the Talkman's operating frequency to our six-meter ham band led immediately to thoughts of a conversion to 50 MHz. Unfortunately, the Talkmans I tested were not my own, so I was not at liberty to tamper with the innards. A schematic is included with each Talkman, and it appears that altering the operating frequency would not be too difficult. I'm sure it won't be long before we see a few of these little gems on six meters.

In Conclusion

I'd be the last to claim that the Talkman represents any sort of communications breakthrough. Still, for many uses—keeping track of buddies at a hamfest or talking to earthbound helpers from the top of your tower, for example—the Talkman may prove far handier than your handie-talkie. Perhaps we'll begin to see Standard's very convenient headset concept spreading soon to our portable ham rigs. It can't happen too soon for me.

For further information, contact *Standard Communications, PO Box 92151, Los Angeles CA 90009.* Reader Service number 486.

Jeff DeTray WB8BTH
***73 Magazine* Staff**

DX

THE UK SCENE

Last year, my family and I enjoyed a holiday in Florida. We tramped most of the usual tourist paths including the Seaquarium, the Kennedy Space Center, the beaches, the fast food stores (still something of a novelty in England), and, of course, Disney World.

Obtaining a reciprocal license was the easiest of all the jobs necessary in planning my USA visit. A photocopy of my current license together with an official letter confirming that it was still active sent to the FCC brought the necessary document within a few weeks.

When I received the reciprocal license, I realized that the only way I could get some HF operating (not being really interested in VHF) was to visit a local ham. I mentioned to Fred Van Aalst WD4RAF, who lives in Fort Lauderdale, that I was planning a visit to Florida and he kindly invited me to meet with him.

While my family and Fred's XYL, Pearl, did some shopping, I activitated G4EJA/W4. Needless to say, it was on a day when the HF bands were in poor shape and I was unable to make any contact with Europe. I called "CQ DX" on 15 and was answered by a WØ. It was a moment before that I realized I was probably as far from him then as I would be at home. There is little point in me describing operating in the US (that would be taking coals to Newcastle, to quote a quaint English proverb).

Jeff Maynard G4EJA operating at the desk of Fred Van Aalst WD4RAF in Ft. Lauderdale, Florida.

The shack of G4EJA showing the RTTY gear with W/K QSL cards in the background.

What might be of interest, however, is the view from this side.

There is no equivalent of the FCC in the United Kingdom. The regulatory body for amateur radio (and for all other aspects of radio) is the Home Office. This is a government body, headed by a Minister (Secretary of State), which looks after, among other things, the police and the maintenance of law and order. The main instrument of control is the Wireless Telegraph Act of 1944 which empowers the Secretary of State to do just about anything. The Home Office is assisted by the Post Office (now known as British Telecom) in such matters as interference suppression and equipment testing.

The first requirement for a license is to pass the Radio Amateur's Examination, known by everyone as the RAE. Sittings for the RAE are held twice each year, usually in May and December, with the results being announced about three months later in each case. The examination paper, which is set by the City and Guilds of London Institute on behalf of the Home Office, is divided into two parts.

Part One deals with licensing conditions and Part Two covers elementary radio theory and operating procedures appropriate to the Radio Amateur Service. For a candidate to be successful, 55% or more of the multiple choice questions must be answered correctly.

An RAE pass slip is all that is required for a "B" license permitting operation at 144 MHz and above (all modes except CW). The "A" or full license for operation on all bands and all modes requires a CW test in addition to passing the theory exam.

The Morse test, which is administered informally by the British Telecom, requires the applicant to send and receive plain text and figure groups at twelve words per minute. Punctuation and procedure signals are not part of the test.

With the license comes a callsign. A particular letter sequence can be asked for and will be given if not already allocated; however, the applicant must wait until that special sequence is ready for issue. The UK callsign system is based on Civil Service logic and is therefore impossible to understand. However, this story would not be complete without a description, so here goes!

The callsign consists of four parts: country identifier, class of license indicator, unique licensee sequence, and optional suffix.

The country identifier is one or two letters at the beginning of the call that indicates that part of the United Kingdom from which the station is currently operating. The prefixes are G—England, GM—Scotland, GI—Northern Ireland, GW—Wales, GD—Isle of Man, GJ—Jersey, and GU—Guernsey.

The country identifier changes when the station moves. Thus if I drive about 25 miles south into the principality of Wales, my callsign becomes GW4EJA/M. This highlights the major difference between UK and USA callsigns; in the UK, the combination of figure and letter sequence (e.g., 4EJA) is unique.

The figure following the country identifier indicates the class of license (except as noted below) as follows: 2,3,4,—A (full) license; 8,6—B (VHF) license.

Some hams from the early days still hold G8 and G6 plus two (e.g., G8AB, G6JM) calls; these are full type-A license holders and are the only way to work these prefixes on HF.

A callsign with a 5 indicates the holder of a reciprocal license.

If I operate from a car, the usual /M is added. The suffix /P is added when operating from a "temporary location" or as a pedestrian. Operating from temporary premises requires the use of the suffix /A (presumed to represent "alternative").

If you understand this all so far, the picture is completed with the GB prefix used for special event stations. Two particular GB callsigns to look out for are GB2RS, the news bulletin station of the Radio Society of Great Britain, and GB2ATG, the RTTY news bulletin station of the British Amateur Radio Teleprinter Group (BARTG).

Having crossed the various bridges to date and obtained a full (A) license, the road is by no means as smooth as it might be. The Wireless Telegraphy Act already mentioned is fraught with problems for the unwary. It is a requirement of the UK amateur license that a licensee must be able to verify that his transmissions are within the authorized frequency band.

It is not permitted in the UK to listen to transmissions other than from authorized broadcast stations and radio amateurs.

The final damping factor is a feature of UK local goverment; it is necessary to obtain "planning permission" for any permanent structure over 10 feet in height. I spent two years battling with my local authority before being allowed (somewhat reluctantly) to erect a tower. Even then the permission was only for a tilt-over and included the rider that it "should be erected for no

OBTAINING A UK RECIPROCAL LICENSE

Citizens of the US intending to visit the United Kingdom may obtain a reciprocal G5 license providing they hold a General, Extra, or Advanced US license (holders of Novice and Technician licenses *cannot* apply even for a UK B-type license).

Applications, on the appropriate form together with a photocopy of the applicant's current license, should be sent to: Amateur Radio Regulatory Dept., The Home Office, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

If a permanent address in the UK can be given, a license for 6 months will be issued; otherwise, a two-month mobile license is given. The current fee is £8. (US $16) for either of these. The callsign will be in the series G5O--.

more than 15 daylight hours per week."

So that's a quick look at the UK amateur radio scene. I hope it will contribute something to more and better QSOs across the pond. Any reader lacking a QSO with England is welcome to a sked (write or telex to 628811) on CW, SSB, or RTTY (or even SSTV with some notice), and if you hear me, I am still chasing counties for QCA and I need Wyoming, Utah, Nevada, Montana, Idaho, and Nebraska for WAS!

Finally, thanks again to Fred WD4RAF for his help in introducing me to stateside operating. Any US hams traveling this way are welcome to call.

Jeff Maynard G4EJA
Cheshire, England

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

CLANDESTINE RADIO

This month's column is devoted to clandestine radio. Recent events have once again proved to us that the right of operating free and open radio stations is something we should never take too lightly. Over the years, both amateurs and non-amateurs have suffered when the privilege of unhindered radio communication has been yanked away by autocratic regimes. This month we pay tribute to those brave individuals and groups who have put the public's right to know above their own personal safety.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) Underground user's gear is usually this
7) Attack feared by resistance groups
10) Iranian religion
11) Cuban station—digit
14) 3.1416
15) Bury or understand
17) Morse, Baudot, etc.
18) Direction__________ equipment
21) Where the generals stay
24) A communication device using the sun's rays: __________ graph
26) Martial law country's prefix
28) US propaganda station (2 words)

Down

2) An interference (abbr.)
3) Audio-visual (abbr.)
4) A banished citizen
5) Prison QTH
6) Favorite Soviet radio activity
7) Commie color
8) Clandestine operators often face this
9) What you are
12) Action of 24 across
13) WWII radio invention
15) Opposite of don't
16) Identification (abbr.)
17) Secret code
19) Press station
20) Opposite of stereo
22) Energy (abbr.)
23) Baudot medium (abbr.)
25) It goes with every pot
27) English tavern

ELEMENT 2—MULTIPLE CHOICE

1) Which nation runs "Radio Peace and Progress"?
   1) Soviet Union
   2) Panama
   3) United States
   4) Japan

2) Which of the following is *not* a US military station?
   1) WAR
   2) WIN
   3) NAV
   4) AIR

3) An American underground TV station? Well, it happened in Syracuse, New York, in the fall of 1977. What sort of programming did "Lucky 7" provide its surprised viewers?
   1) Cartoons
   2) Pornographic movies

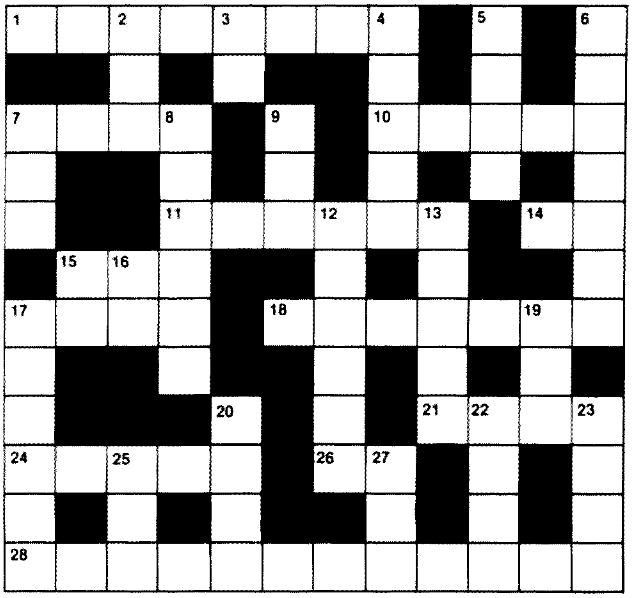


Illustration 1.

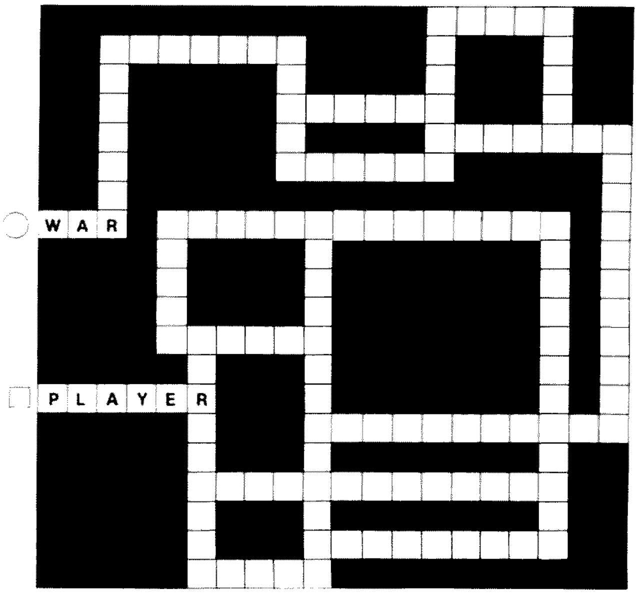


Illustration 2.

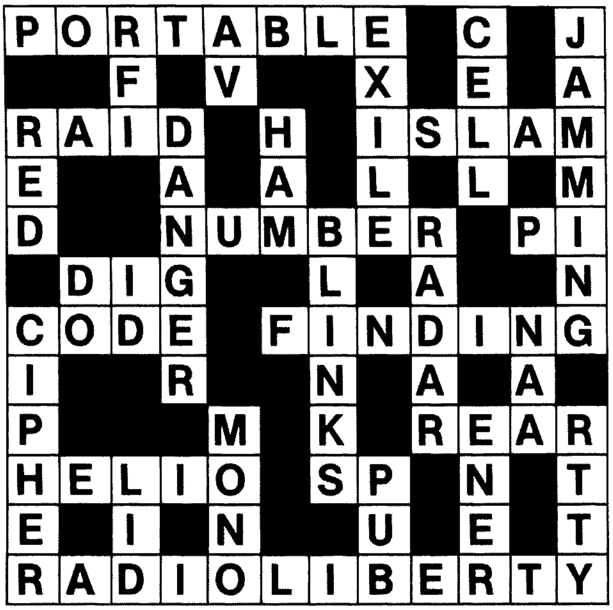


Illustration 1A.

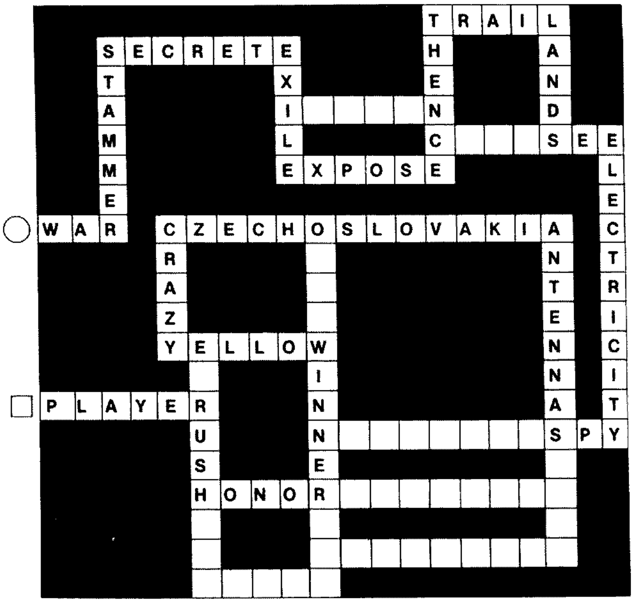


Illustration 2A.

3) Revolutionary propaganda
4) Game shows

4) One of the oldest active clandestine broadcast stations is "Radio Espana independient." It began operation in:

1) 1920
2) 1941
3) 1954
4) 1975

5) Back in the 1960s, the CIA ran a propaganda station on an obscure Caribbean Island. What was this island's name?

1) Swan Island
2) Hammarlund Island
3) Johnson Island
4) Hallicrafters Island

ELEMENT 3—ALPHABET GAME

Complete the names of the five clandestine broadcast stations listed below by placing letters of the alphabet on every dash. Use each letter only once. The letters J, K, W, X, and Z are not used.

A B C D E F G H I L M N O P Q R S T U V Y

1) VOICE/OF/NA_IB_A
2) VOICE/OF/_A_E_TI_E
3) VOICE/OF/__RE_/_ANAR_/ISL_N_S
4) VOICE/OF/T_E/_AS_UE/_NDER_R_UND
5) VOICE/OF/THE/E_I_REA/RE_OLUTION

ELEMENT 4—HAMAZE
(Illustration 2)

Here's a new type of maze specifically geared to hams. The object is to start at the circle and trace your way to the square by filling in the answers to the clues given below. To help you on the way, we've already given you the first and last clue answers. All words read either vertically downward or from left to right. Each new word is on a *perpendicular* angle to the previous word. Words join on a common letter. Good luck.

1) Organized aggression
2) Stumble speak
3) To hide
4) An organization that may run a clandestine station: ________________ group
5) Discreditable revelation
6) From that place
7) A path
8) Disembarks
9) To view
10) Energy often in short supply to underground stations
11) Secret watcher
12) Aerials
13) 1960s Soviet invasion place
14) Nuts
15) One who is chicken
16) Victor
17) Self-respect
18) Hurry
19) One who plays

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1—1 Peacefully progressing toward what? It's the USSR's answer to Radio Free Europe. (They couldn't call it "Radio Enslaved Europe," could they?)
2—2 WIN was a button.
3—2 Pass the popcorn.
4—2 Patience is a virtue.
5—1 How about "Kenwood Island"?

Element 3:
1—VOICE OF NAMIBIA, 2—VOICE OF PALESTINE, 3—VOICE OF FREE CANARY ISLANDS, 4—VOICE OF THE BASQUE UNDERGROUND, 5—VOICE OF THE ERITREA REVOLUTION.

Element 4:
See Illustration 2A.

SCORING

Element 1:
Twenty-five points for the completed puzzle, or 1/2 point for each question correctly answered.

Element 2:
Five points for each correct answer.

Element 3:
Five points for each correct answer.

Element 4:
Twenty-five points for the completed puzzle, or one point for each word solved.

How'd ya do?

1-20 points—"Is the VOA clandestine?"
21-40 points—Once heard Radio Peking.
41-60 points—Scans the band—but hears nothing.
61-80 points—Single agent.
81-100+ points—Double agent.

NEW PRODUCTS

DRAKE'S NEW TRANSCEIVER AND RECEIVER

The R. L. Drake Company has announced new models of its TR7 communications transceiver and R7 receiver. Features new to the TR7A include standard 9-kHz receive selectivity for AM reception, 500-Hz crystal filter for CW reception, built-in noise blanker, improved lightning protection, and a new phone-patch audio input.

The new R7A receiver features a noise blanker, 500-Hz CW crystal filter, and 9-kHz AM selectivity. These units also interconnect to make a "twins" system, offering complete frequency flexibility and dual simultaneous receive. The TR7A has a suggested price of $1699 and the R7A lists for $1649.

For more information, contact *R. L. Drake Company, 540 Richard Street, Miamisburg OH 45342; (513)-866-2421.*

SEVEN-ELEMENT TRIBANDER

A new tribander, the TH7DX, is now available from Hy-Gain. The TH7DX features a dual-driven element system that maintains a vswr of less than 2:1 on all bands including the entire 10-meter band. The driven elements utilize Hy-Gain's Hy-Q traps capable of handling power levels well in excess of the legal limit. These traps allow element lengths of 0.225 wavelength on 10 meters, 0.203 wavelength on 15 meters, and 0.185 wavelength on 20 meters. The dual-driven elements are fed directly with Hy-Gain's 50-Ohm BN-86 balun.

Tests show average front-to-back ratios of 22 dB on 20 and 15 meters, and 17 dB on 10 meters. The average half-power beamwidth varies from 66 degrees on 20 meters to 63 degrees on 10 meters. With a turning radius of 20 feet and the longest element 31 feet, the antenna is no larger than the Hy-Gain TH6DXX. The TH7DX weighs 75 lbs., has 9.4 square feet of wind surface area, and wind loading of 240 lbs. at 80 mph. The TH7DX, complete with stainless steel hardware, balun, and boom-to-mast clamp, is priced at $499.95.

Hy-Gain also has announced that kit model 392S is available to convert the older TH6DXX to a TH7DX configuration for a suggested net of $199.95.

For more information on these products, contact *Hy-Gain Division, Telex Communications, 9600 Aldrich Ave. So., Minneapolis MN 55420; (612)-884-4051.* Reader Service number 481.

INDUCTIVE MODEM

MFJ Enterprises has introduced their new MFJ-1230 originate/answer modem. The 1230 uses an inductive coupling technique for receiving. This gives reliable data transfer by eliminating errors caused by room noise, vibration, and other acoustic-coupling problems.

This Bell 103-compatible modem operates from 0 to 300 baud, features half- and full-duplex operation, and is crystal-controlled for high stability. An Apple version that plugs into the game port (MFJ-1231) is also available, complete with software.

The MFJ-1230 and MFJ-1231 inductive-coupled modems are available for $129.95 and $139.95 respectively.

For more information, contact *MFJ Enterprises, 921 Louisville Rd., Starkville MS 39759; (601)-323-5869.* Reader Service number 480.

H-8 AND H/Z-89 PROGRAM

MLM Associates now offers a Morse code transceiver program for Heath/Zenith H-8 and H/Z-89 owners interested in digital communications. MLM Morse converts International Morse code from a receiver into an alphanumeric video display and changes characters typed at a terminal into the form needed to activate a transmitter or code-practice oscillator. Features include fast break-in CW operation, automatic switching between transmit and receive, and a split-screen display.

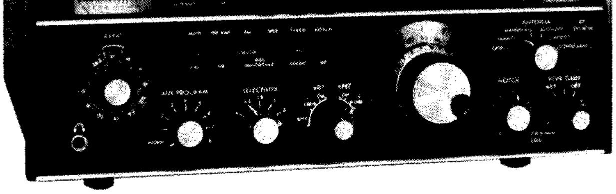
The instruction manual gives details for building a CW-to-computer interface or you can use a RTTY modem. MLM also offers the MFJ-1200 computer interface. The software package sells for $29.95. A complete package including software, interface, and power supply is $99.95.

To order, or for more information, contact *William S. Hall, MLM Associates, 5621 Maple Heights Court, Pittsburgh PA 15232; (412)-683-4742.* Reader Service number 477.

MICROPHONE EQUALIZER

The first in a series of new products from Heil, Ltd., is their EQ 200 Microphone Equalizer for speech applications with SSB and FM transmitters. The EQ 200 allows you to equalize your amateur station in a manner similar to the technique used by broadcast stations and recording studios.

This battery-powered device measures 4" × 4" × 1-1/2" and plugs into the microphone line. The three controls, mike gain, low-frequency adjust, and high-frequency adjust are set with



The Drake TR7A transceiver (top) and R7 receiver.

The MFJ inductive-coupled modem.

the aid of a second receiver or another station. Distortion level is 0.09%. Microphones of any impedance will work, but low-impedance microphones are recommended since they usually offer better RFI protection. The EQ 200 costs $49.95.

For more information, contact *Heil, Ltd., #2 Heil Dr., Marissa IL 62257.* Reader Service number 479.

SURGE PROTECTORS

Alpha Delta Communications' Transi-Trap Surge Protectors are gas surge arresters designed to protect sensitive electronic equipment from damage due to excessive voltages or currents generated by transient phenomena. The elements in the Arc-Plug™ cartridge are constructed of two metal electrodes hermetically sealed in a gas-filled ceramic cylinder. They perform as voltage-dependent switches which can reliably and repeatedly carry large currents for brief periods of time.

Alpha Delta Transi-Trap Protectors are designed for indoor installation at the rear of the equipment. If outdoor use is planned, it will be necessary to coat all surfaces thoroughly with a good sealer. The Model R-T low-level protector is designed for use with solid-state receivers, transceivers, or transmitters that run up to 200 Watts into 50 Ohms. It costs $29.95. The Model HV high-voltage protector is for use with linear amplifiers running up to two kW into 50 Ohms and sells for $32.95.

For more details, contact *Alpha Delta Communications, 116A North Main St., Centerville OH 45459; (513)-435-4772.* Reader Service number 476.

CW-TO-RTTY CONVERTER

Kantronics is introducing a RTTY send/receive device that converts CW from any keyer or keyboard into standard AFSK two-tone RTTY or two-tone CW ID. Micro-RTTY sends and receives at 60, 67, 75, and 100 wpm, plus 110-baud ASCII.

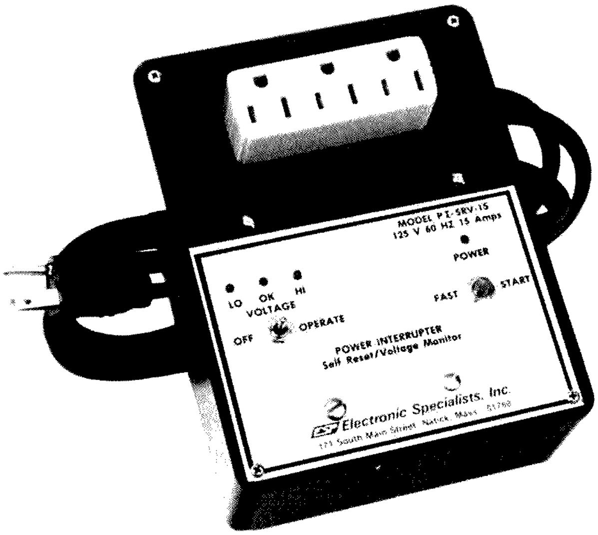
Features include special CW characters for sending a line-return/carriage-feed character and a print attachment. Micro-RTTY receives any shift of RTTY and displays the message on a ten-character, 3/8"-high vacuum-tube fluorescent display. The 2-1/2" × 5" × 5-1/2" package comes with a 9-volt dc power supply and has a suggested price of $299.95.

For more details, contact *Kantronics, 1202 E. 23rd St., Lawrence KS 66044; (913)-842-7745.*

POWER LINE INTERRUPTER

Electronic Specialists now offers an automatic-reset ac power line interrupter. Should the ac line voltage be disrupted or exceed preset safety limits, the power interrupter disconnects ac power from controlled apparatus. A 4-minute timer delay, followed by automatic reset, helps avoid wide voltage fluctuations.

Intended to operate unattended for long periods, the self-reset power interrupter also offers an optional voltage monitor. Connecting to the ac line with a standard 3-prong plug, the power interrupter can accommodate a 15-Ampere resistive load or a 10-Ampere inductive load. The Model PI-SR-15 interrupter costs $185.95; the voltage monitor option costs $20.00 extra.



Electronic Specialists' power line interrupter.

For more information, contact *Electronic Specialists, 171 South Main St., Natick MA 01769; (617)-655-1532.* Reader Service number 482.

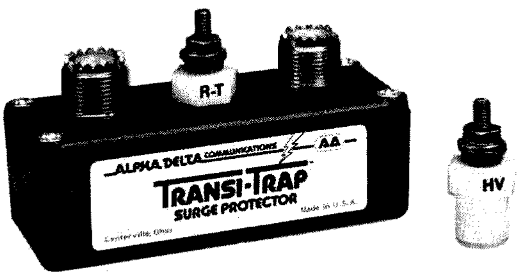
MIKE STAND

Your mobile microphone can now be turned into a base station unit with Valor Enterprises' new Big Ben mike stand. The Model 221 features a black finish and costs $5.90. A chrome version, Model 221C, is also available for $7.90.

To order, or for more information, write to *Valor Enterprises, West Milton OH 45383; (513)-698-4195.* Reader Service number 478.

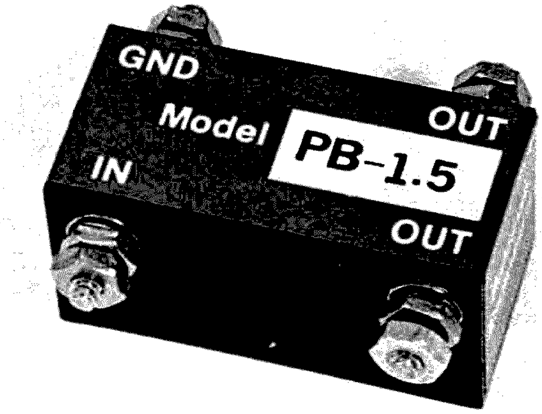
COMPACT ANTENNA BALUNS

Palomar Engineers is introducing a new series of baluns. The Model PB series will match



Transi-Trap gas surge protectors.

The Big Ben mike stand.

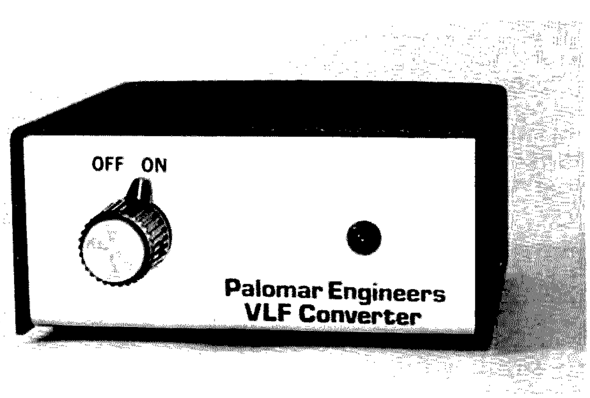


Palomar Engineers' antenna balun.

50-Ohm coaxial cable to 50-, 75-, 100-, 150-, 200-, 250-, 300-, 375-, 450-, 600-, or 800-Ohm balanced antennas. They also can be used as matching transformers for various purposes.

The Model PB series work at power levels to 350 Watts PEP and are 1-1/2" x 3/4" x 3/4" in size. They operate from 1.7 to 30 MHz, are fully encapsulated, and have stainless steel hardware. The PB baluns sell for $14.95.

For further information, contact *Palomar Engineers, 1924-F W. Mission Rd., Escondido CA 92025; (714)-747-3343.*



Palomar Engineers' VLF converter.

VLF CONVERTERS

Palomar Engineers is introducing two new converters for the 10-500-kHz band. They add reception of weather, ship-to-shore CW traffic, RTTY, WWVB, navigation beacons, 1750-meter no-license band, and European low-frequency broadcast stations.

Model VLF-A converts to 3510-4000 kHz for use with ham receivers and transceivers. Model VLF-S converts to 4010-4500 kHz for general-coverage shortwave receivers. With digital readout, the last three digits read frequency.

The new converters feature antenna bypass when turned off, LED power indicator, and low-current, nine-volt dc operation. The VLF-A and VLF-S sell for $79.95.

For further information, contact *Palomar Engineers, 1924-F W. Mission Rd., Escondido CA 92025; (714)-747-3343.*

LETTERS

ATV GOES MONTHLY

Amateur Television Magazine has expanded publication to 12 issues per year beginning with the March, 1982, issue. Now in its 15th year of service to specialized communications operators, *Amateur Television Magazine* covers all modes of amateur television such as FSTV, NBTV, MSTV, and SSTV as well as coverage of FAX, RTTY, microwave, EME, satellites, CATV, and computers.

It was Henry B. Ruh KB9FO, former publisher of *ATV*, who petitioned the FCC to allow SSTV operation in the HF General Class phone segments. This proposal was adopted and is expected to become effective sometime in early 1982, giving a tremendous boost to SSTV activity.

Mike Stone WBØQCD
Publisher, *ATV Magazine*
PO Box H
Lowden IA 52255

CHARLIE IS BORN

I just read "Messages From Station Charlie," which appeared in the January, 1982, issue of *73*. It was well written and brought back many memories, some pleasant and others I'd rather forget. Perhaps other readers may be interested in the genesis of "Charlie"—station 53C.

In September, 1942, I was assigned to the Office of Strategic Services (OSS), Washington DC. After indoctrination, I was sent to London to confer with [Major General Sir Colin] Gubbins and [Brigadier F. W.] Nichols of the British Special Operations Executive (SOE) with respect to the establishment of an American station to supplement British stations 53A and 53B. The original concept was that we would handle the agent circuits into Norway. The British would arrange for us to get the land required and would furnish Ministry of Works personnel to do the construction, and we would provide the equipment and manpower.

The first thing I did was to drive out London's Great West Road with a receiver, stopping here and there at likely-looking spots to check reception conditions. I saw a road leading up a hill and found myself in a farm worked by Italian prisoners. They doffed their caps and opened gates so I could reach the top of the hill where I found a very large flat area, with low noise level and good reception.

Since throughout England all place-name signs had been removed from roads and railroad stations and buildings, I mapped my route from London to the site with the names of pubs (e.g., Compleat Angler) so that I could identify where I had been when I got back to London!

I am envious of the author's good fortune in meeting those former agents aboard the *Gripsholm*. In my case, I met only one after the war. His name was Robert, and I spent a lovely evening with him and his mother at their home in Paris.

G. L. Graveson K4JI
CDR, USNR (Ret.)
Plantation FL

BINARY STIMULATION

I never write to editors, but had to make an exception in order to respond to your comments concerning CW in your January editorial. The concept of high-speed, computer-based radio communication is definitely an intriguing one, but I must observe that nothing matches Morse code for versatility or CW for simple rf communication.

The average human mind, trained in the use of the code, can interpret the variations in a binary-state stimulus, deriving through that process the information being encoded by the sender. The sender can encode the vast range of human thought that has been or can be reduced to words of human language. I believe the development of the code to be one of mankind's most magnificent achievements.

What do you suggest replacing it with? I know next to nothing about BASIC or other computer languages, but I do know enough to doubt that anyone can communicate with it using an rf oscillator keyed by touching a couple wires to-

gether, as many hams have done at one time or another. As an example of versatility of the *type* of binary system used for transmission, consider the feat of surreptitious communication pulled off by Jeremiah Denton when "interviewed" by his North Vietnamese captors: Using the code, he spelled out the word TORTURE using eyeblinks as the binary system. What computer language would offer such a possibility?

I'm not sure that these comments constitute sufficient reason for the code to be retained as one of the hallmarks of the radio amateur, but radio amateurs are usually people who are intrigued by the notion of action at a distance. The idea of communication over vast distances via an insensible medium is one of the things that "hooks" us on this hobby, and the code makes the medium useful with the least moving parts, which I interpret as being efficient. I sincerely believe that it should not be replaced by a system which requires complex contrivances to access that medium.

R.D. Barnum, D.M.D.
Tahlequah OK

Hi, Ray—It's good to hear from one of the "let's go back to smoke signals" crowd. I don't know what band you operate, Ray, but on most of the CW bands I listen to I do not hear a vast range of human thought being expressed, just the usual garbage of name, location, signal strength, my rig is . . . and 73. Ad infinitum. The code is merely a way to send characters, not thoughts. The characters . . . the same ones we use on our typewriters and that more and more hams are using for code generation (if you've noticed the ads for code-typing systems) . . . can be used to communicate words. The words eventually, in some cases, can be used to communicate thought. No one wants to change that. But it was not my suggestion that amateurs stop using CW; that's a straw man of your construction. I've suggested that we stop making newcomers hate CW by jamming it down their throats. I've tried to point out that anyone who thinks that the code test is keeping out undesirables is blind to what has happened.— Wayne.

TEETHING ON CW

The first thing I turn to when *73 Magazine* arrives each month is "Never Say Die." In spite of your caustic comments about the FCC and *QST*, it makes good reading.

Over the past few months you've bored me somewhat, talking about your business acumen, your contact with the avant-garde of amateurs, your DX operations, plus miscellaneous other achievements. Oh, and your dislike of CW.

Wayne, I cut my teeth on CW in the early thirties when that band was only CW. I've continued in my devotion to CW. Man, it's a language; you have to talk it to retain your ability. I was a Navy Radioman on CW during all of WWII. Early in my ham career I made one 75-meter phone contact. I had mike fright so bad that it wasn't until the early fifties that I got on phone again. Now I spend about 50% of my operating time on SSB.

Being something of an underachiever ham, I sincerely appreciate your fighting spirit, Wayne. As you requested, here are some thoughts about our hobby's social events.

A repeater group has a monthly get-together with wives and children at a local restaurant. For each ham, it's an ego trip. And there are picture-takers and practical jokers. Some are neat; others are slobs. Some act educated; some don't. It's a strange cross-section of humanity, all united by the bond of amateur radio. This group conducts no business. The members simply accept the pleasure of each other's company. The wife and I go as often as we can.

I have been a member of my local club, the Shawnee Amateur Radio Club, for several years. The part of the meeting I always enjoy is the free discussion prior to the business meeting. This is the time I meet and enjoy personal contacts with the local hams. Business meetings are a drag. I'd prefer the nitty-gritty to be handled by the officers at another time.

After the business session comes an "enlightening" talk by an uninformed member—or a slightly-askew slide presentation that I fervently wish I had not stayed for. I stayed for one movie, obtained at considerable effort, which proved to be about 15 or 20 years behind the times. Your suggestion for the "Show and Tell" presentation sounds like a real winner. I hope to see more of this.

Another social event is the hamfest. Except for the horrible crush of Dayton, I always end up with good vibes from hamfests.

About 25 years ago, I joined the Quarter Century Wireless Association and went to an outing at Greenfield Village near Detroit. My immediate reaction was claustrophobia. I had been captured in time many years hence. I wasn't ready for this. I am now a life member of QCWA. My wife and I attend occasional dinner meetings in Indianapolis. Another ego trip, but fun.

Speaking of fun, the real fun of amateur radio is building (or buying) and getting on the air with what you have to communicate with others of like persuasion, talking with other hams, making new friends, and keeping in touch with old friends, on SSB, FM, CW, RTTY, ASCII, SSTV, ATV, OSCAR, or whatever comes down the pike. Long live ham radio!

73 from ex-W9IDP, -W8HXA, -W5JYE, -W0QBF, W9MTR, and -W9LNX.

Paul L. Schmidt W9HD
Bloomfield IN

Paul, we all had to cut our teeth on CW. There is nothing to be proud of for that; we had no other choice. If we can stop trying to use CW as a weapon to ward off people who want to be hams and value it as an art, as the real spirit of amateur radio, perhaps we can be proud of it then. Right now I'm ashamed of CW, for it has failed us utterly in keeping out the trash. I'm pro-CW for fun and keeping up the spirit of amateur radio . . . just let's stop turning prospective hams off it by using it as a weapon against them. You're right about business meetings being a drag . . . keep 'em out and let the club/executive committee waste its hours on that bunk.—Wayne.

CLIMB ON!

After reading all the latest about the League, the plain language debate, and other such discouraging issues, it was most refreshing to read the wonderful article by Scott Nelson W7KUF about their Mount McKinley expedition. It is really uplifting to read about the true functions of amateur radio in action. If not anything else, it will drive me to re-up with *73* to keep informed, join one of the many clubs around here, and volunteer for some of the activities for which the hobby used to be noted. Wayne, I know that throughout the years you have always championed the good cause, and sometimes I wonder where you get all the energy for all the work you do. Be assured that many of ham radio's "silent majority" are behind you 100% and your continued rallying will drag us out of the woodwork, like me. Have a great year!

David R. Waters WA6AWZ
San Jose CA

I feel better already.—Wayne.

HOME-BREWING

Let me congratulate you on the "Home-Brew Contest," which is an excellent idea! The current economic woes of this country have made it all but impossible for amateurs like myself, who have a family to support, to upgrade a station with new equipment. Kits and good used equipment also seem out of the question. The home-brew route provides an alternative to this problem. I would be able to purchase the components as I could afford them and learn a lot more about the state-of-the-art of amateur radio as well.

I might add that your idea underscores what I feel is a growing indifference at the ARRL to the basic needs of the amateur. While I will continue to remain a member of this organization, I am not at all happy with the direction they are going. An amateur who can barely afford to get on the low bands or two meters doesn't need articles on how to track the moon, build a QRP rig in a sardine can, or build expensive accessories. Granted, they do publish an article on receiver construction or the like from time to time. And, granted, there are construction projects in the *Handbook*, but I find the construction details sketchy. This, coupled with the cost of the components, tends to scare me off. This leads me to a suggestion.

As you publish home-brew projects, please consider the possibilitiy of providing detailed

construction plans. By this, I mean a checklist construction guide similar to the method used by the Heath Company. It would certainly give someone like me, who isn't much beyond the code-oscillator stage, the confidence to tackle something like building a receiver.

Right now your business mind is probably rejecting this idea, figuring the cost in money and man hours that would be required to write step-by-step instructions, create illustrations, templates, etc. I agree that this would not be cheap. However, consider the possibility of publishing the construction details a section at a time over several issues of the magazine. Such a continuing series would certainly encourage newsstand sales and subscriptions. The same artwork for the magazine series could also be adapted to your line of amateur publications.

The bottom line, Mr. Green, is that you have an excellent opportunity to make a lasting contribution to the needs of amateur radio. I would encourage you to weigh the possibilities of this idea as you make your publication plans for this contest.

A Shy WD9

First-rate idea.—Wayne.

FUN, CHEAP, AND...

After reading all the "crank" letters in the January, 1982, *73*, I decided to write one of my own. First, I'd like to take issue with people who write in and say that amateur radio is a rich man's hobby. That's a silly statement. Today people pay $500 to $700 for a color TV, $10 to $30 a month for cable charges, $25 for tickets to a bowl game or concert. Amateur radio is cheap entertainment when compared to these other diversions. A state-of-the-art transceiver can be bought for around $500. With a little care, those solid-state beauties will easily last ten years. If an amateur buys one of these rigs, operates twice a week, and brews a pot of coffee each night he operates, at the end of ten years he has spent more on the coffee than the rig. Even then, he could recover a good fraction of his investment by selling the used rig. (For example, check the prices for a used Heath HW-101 compared to the price for a new kit seven or eight years ago. That almost amounts to free entertainment.)

Next, I'd like to console the old-time tinkerers. Tubes are still available. They're cheap. They're functional. If you want to build old-time gear, do it. I've built a few tube CW transmitters and have enjoyed the construction and operation. Please do not yell about others using integrated circuits and transistors. The old-timers were working with state-of-the-art in 1929, and in 1929 tubes were as mysterious as integrated circuits are now (to anyone refusing to learn). This is a hobby, after all. Relax. Read a little, learn a little, and enjoy a lot.

Jim Owens' letter especially bothered me when he said that newcomers in amateur radio must mortgage their homes to buy gear. Jim, take a new guy to a hamfest. Some nice Novice gear (e.g., Heath's HW-16 with vfo, 90 Watts, and full break-in) can be had for less than $100. He doesn't have to sell his home, just carpool for a month and save a few bucks. Jim could even buy such a rig as a spare and loan it to the truly destitute. When the beginner upgrades to a Technician license, he can pick up a rockbound two-meter rig for a similar price. By the time he makes General, he is no longer a newcomer.

Lastly, I'd like to address the people who claim that they are technically oriented and that amateur radio magazines don't publish enough projects. Great! The next time you build a project, take notes, take pictures, write it up, and send it to *73*. Share your ideas with other amateurs, and it will improve the journal you are criticizing.

Amateur radio is fun, cheap, and exciting. If you don't think so, contribute your ideas and improve it. If you can't be bothered to improve or enjoy amateur radio, go to the Y and swim a few laps in the pool. It will be better for your heart and for amateur radio.

Bradley G. Mauger KB5QZ
Greenbelt MD

QSL VIA...

I am QSL Manager for the newly-licensed station VQ9JB on Diego Garcia. The operator, Jay Befort, will be there eight months and I will be handling all of his QSLs. Send your cards to 477 Mose Drive, Biloxi MS 39532.

Shari Runyan WD5BHP
Biloxi MS

LEGITIMATE?

This is in reference to the remarks by Tim Daniel N8RK on cable TV radiation (Letters, January issue of *73*). I am most interested, since I have a foot in each camp.

As a CATV engineer, I resent his shotgun statement, "...many CATV companies are reluctant to upset the apple cart, much less spend any money that would result in a reduction of short-term profits." How many companies? Which ones? How do you know? What do you know about the CATV company's short-term profit?

He says, "The idea of a legitimate amateur repeater shifting its frequency to accommodate CATV does not appeal to me." I remind him that the CATV operation is also "legitimate." The idea, however, is to work together to find a solution, not to hurl tenuously-founded accusations. What he fails to see (or chooses not to recognize) is an old ham problem from way back: The CATV system can be well within FCC specs, i.e., 20 uV/m at 144.25 MHz, and still be copied by a good grade of ham receiver when the antenna is near the cable. Hams have been fighting this forever—talking into a neighbor's hi-fi, although their transmitters are well within FCC specs. The aim is to work with the neighbor to resolve the difficulty.

His final paragraph "...perhaps some high-power transmissions on or about 145.25 MHz will prompt action." makes me cringe. Lynching would also prompt action, but that, too, is unworthy of the ham fraternity. From his letter, I see N8RK as an "I don't like it, so I'll jam it" mentality. As a new ham, I must say he has a vastly different attitude from the many Elmers who have helped me.

Fred Stone KA5MBB
San Angelo TX

Fred, you seem to have read only part of my response. I urged everyone to be "firm but tactful" when trying to solve the problem. A cable system that meets the 20-uV/m rule is not "legitimate" if it violates 76.613b: "The operator of a cable television system that causes interference shall promptly take appropriate measures to eliminate the harmful interference."—N8RK.

SK

After 16 years as the W2 QSL Bureau Manager, I have decided to call it quits. The new bureau's address is North Jersey DX Association, ARRL 2nd District QSL Bureau, PO Box 599, Morris Plains NJ 07950.

Joseph Painter W2BHM is the new manager effective January 1, 1982. The card sorting will be supervised by Ron Levey K2AIO.

The reason for giving up the job? I just celebrated my 81st birthday.

Victor "Digger" Ulrich WA2DIG
Haledon NJ

HAM HELP

I am a Novice who is in search of a working Heathkit RX-1 receiver to complete my station. My income is limited so the price must be very reasonable.

Fred Erickson KA1GGN
105 G. St.
Turners Falls MA 01376

I need help in obtaining a schematic diagram and manual for a Jackson Model CRO-2 oscilloscope, manufactured by Jackson Electrical Instrument Co., Dayton, Ohio. I would be happy to pay for duplication or I will copy and return your original.

Adam J. Patarcity WB3LIQ
47 Bald Cypress La.
Levittown PA 19054

I had a great response to my request for information on the Hallicrafters HT 41, published in the December, 1981, Ham Help. Thank you.

Glenn Churchill KA2IOI
Glens Falls NY

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Wayne is not overly fond of "April Fool"-type articles. I mention this now because as I get into this month's topic some of you are going to begin to wonder if this is for real.

What would you say to the following situation, which might be observed in my ham shack? I *am sitting* at the desk, *tuning* the receiver, looking for stations. The speaker calls out with a male voice, "CQ CQ CQ DE N3BRB." So far not very exciting sounding, is it? But what if I tell you that the station is transmitting on 3620 kHz and is on RTTY? Now I've got you!

What is it that makes this possible? A rather remarkable new device which turns plain text into speech. Unlike speech synthesizers which use prepackaged vocabularies, this unit's abilities are not constrained by such predetermination.

The unit is the Votrax Type 'N Talk (TNT). Based on the Votrax SC-01 chip, this is probably the most capable speech synthesizer on the market. Let's take a look at this rather remarkable device and then consider how the RTTY-voice is possible.

The Type 'N Talk is a small, two-pound box that may be connected to any computer or related device through an RS-232C link. Text to be spoken is sent to it in plain ASCII, using, for the most part, common spelling. The Type 'N Talk contains a text-to-speech translation system that allows pronunciation "by the rules" for normal English speech.

The synthesizer is connected to the host computer (similarly to a modem or serial printer) through an RS-232C interface. A switch located on the rear panel allows selection of baud rates in the 75- to 9600-baud range. The "clear to send" (CTS) and "ready to send" (RTS) lines are used to inhibit transfer of data to the Type 'N Talk when the internal buffer is full. However, users of systems which do not support these functions of the RS-232C interface may alter the feeding software to allow for sufficient delays to provide for buffer emptying. Speech is generated at a rate roughly equivalent to a 110-baud ASCII transmission.

Data sent to the Type 'N Talk is stored in an input buffer of 750 characters. This is roughly one minute of speech. The need for utilization of the CTS-RTS lines becomes obvious when one realizes that at a data transfer rate of 1200 baud, this buffer will be filled in less than seven seconds, or under one second at 9600 baud.

The contents of the input buffer are then submitted to an internal text-to-speech translator which generates the phoneme equivalents of the text input. These phonemes may be recovered from the Type 'N Talk for storage or further processing as ASCII character strings. Normally, the output of the translator is held in a 128-byte output queue, from which it passes to *the* SC-01 speech chip for processing.

An internal amplifier is provided which is capable of driving an 8-Ohm speaker to an acceptable volume. Of course, the audio may also be recorded, sent over the telephone, or otherwise manipulated.

All of this is remarkable enough, but the Type 'N Talk does not stop there. Software switches are provided, toggled with escape sequences, that allow the Type 'N Talk to provide a variety of functions. For example, data sent to the Type 'N Talk may be processed by the unit, passed down the line to the next RS-232C device in a chain, or both. The ASCII output may be either an echo of the input or a phonetic representation of it. And the Type 'N Talk can be disabled but rendered "transparent," so that it can share an RS-232C line with a printer or *other* serial device.

Several modes of operation also are provided for. In the normal mode, the character group "MARC," for example, is pronounced as my name. Unfortunately, sending "WA3AJR" results in a strange sound, something like "wah thre hajr." In order to allow pronunciation of letter groups, a CAPS mode is available. Here, groups of capital letters, as a callsign, are spelled out, and lowercase text is pronounced. This allows a great deal of flexibility in handling the type of text we frequently see in RTTY (see, there's one of those groups!).

The diagram in Fig. 1 is an attempt to show many *of* these functions and switches in a schematic form. It should be obvious that this is not a simple device, but through its complexity it makes operation straightforward.

But how about that RTTY program, I hear you asking? What I did was take a routine that receives Murray code and modify it to output not only to the screen but also to the Type 'N Talk connected to the computer. I have also provided keyboard commands to switch from the CAPS ON mode to the CAPS OFF, *so* that the CQ is easily identified but the text in a message is pronounced rather than spelled.

Fig. 2 is a flowchart for the program; the full source listing for 6800 computer will be here in RTTY Loop next month.

Turning to the mailbox, we find a note from Don McAllister N7AVJ, in Cedar City UT, who is looking for RTTY programs to run on the new VIC-20 computer. This new entry from Commodore, the folks who brought you the PET, uses the same 6502 CPU that the Apple and KIM use. I suspect, therefore, that some-

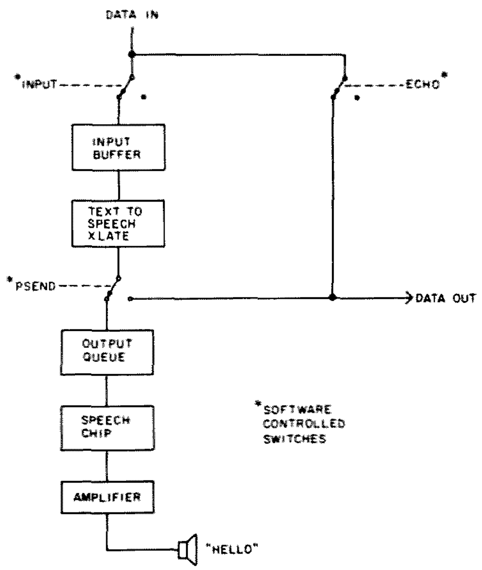


Fig. 1. Block diagram of the Votrax Type 'N Talk.

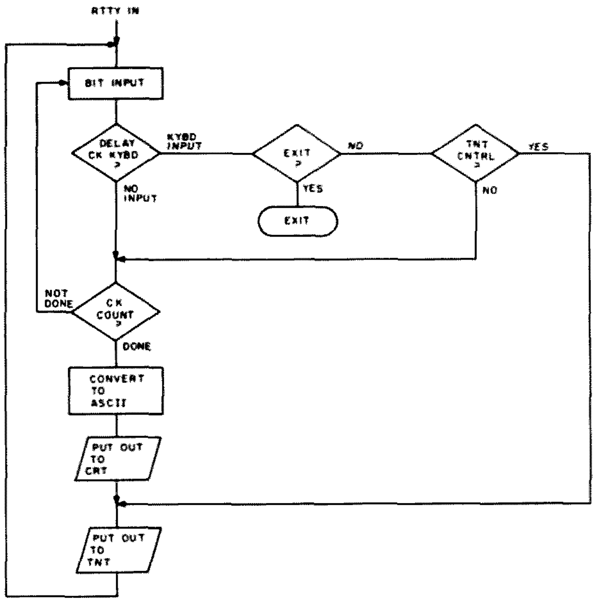


Fig. 2. Flowchart for voice RTTY software.

one handy with 6502 code could adapt one of the many published RTTY programs originally designed for one of those to run on the VIC.

Don also would like to try to put his Sinclair ZX-80 on RTTY. Now, there's a toughy! While this little gem uses a Z-80, my sources tell me that external interfacing may be a bear. I don't have any ready solutions for these problems, Don. If any readers do pass it along, we will share it with all of you.

It's not only the newer systems which keep us on our toes, though. Elston Swanson W3PEE, in Locust Valley NY, has a CP/M-based system—I presume based on an 8080 CPU—that he would like to put on the air on Murray code. Although he has modem drivers for ASCII work, he would like to have a similar Murray routine to allow file transfers and the like.

There have been many RTTY programs published for various 8080- and Z-80-based systems, Elston, and we included a list of the most recent ones in this column a few months back. I suggest you look over some of those programs to see if you could not build a Murray driver into your modem program. That might give you the flexibility you desire without having to reinvent the wheel.

Of course, any readers who are running a CP/M-based Murray system are encouraged to share the information with us all. I never cease to be amazed at the diversity of equipment being used to communicate on this one common mode, RTTY.

We started getting pretty diverse right here this month, what with a voice output for RTTY and all. The program and such will be next month's highlight, along with more surprises, all here in RTTY Loop.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CW & RTTY WORLD CHAMPIONSHIPS

CW Event: 0000 to 2400 GMT, April 3
Phone Event: 0000 to 2400 GMT, April 4

Sponsored jointly by *73 Magazine* and the *RTTY Journal*. Use all bands, 10 through 80 meters, on the specified mode. Cross-mode contacts do not count. The same station may be worked *once* per mode.

Operator classes are: a) single operator, single transmitter, non-computerized; b) single operator, single transmitter, computerized; c) multi-operator, single transmitter, non-computerized; and d) multi-operator, single transmitter, computerized. Single operator stations may work 18 hours maximum per mode, while multi-operator stations may operate the entire 24-hour period. Off times are no less than 30 minutes each and must be noted in logs. To be eligible for the computerized class, your station must be interfaced with a microprocessor-controlled RTTY and/or CW operating system such as the TRS-80, Heath/Zenith, Apple, PET, OSI, Hal, etc. Utilizing a memory keyer for CW does not constitute a computerized station.

Entry categories are: a) CW only, b) RTTY only, and c) CW and RTTY both.

EXCHANGE:

Stations within the 48 contiguous United States and Canada must send RST and state, province, or territory. All others will send RST and a consecutive contact number. If your station is computerized, add the letter "C" to the end of your exchange.

SCORING:

Count 1 QSO point for each valid contact. An additional *bonus* point is earned if the station worked is computerized and sent a "C" at the end of his exchange. Count 1 multiplier point for each of the 48 contiguous United States and each Canadian province/territory and DX country (outside the contiguous US and Canada). The total claimed score is the total QSO points times the total multiplier points.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts and Canadian provinces and territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 5 hours and 50 QSOs must be worked on a mode to be eligible for awards.

ENTRIES:

Entries must include a *separate* log for each event entered, a dupe sheet, a summary sheet, a multiplier check list, and a list of equipment used for each mode of operation. Contestants are asked to send an SASE to the contest address for official forms!

Omission of the required entry forms, operating in excess of legal power, manipulating scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

Entries must be postmarked *no later than* May 10th and sent to: CW and RTTY Championships, c/o The *RTTY Journal*, PO Box RY, Cardiff CA 92007.

VS6 ACTIVITY DAYS

Starts: 0001 GMT April 3
Ends: 1700 GMT April 4

As many VS6s as possible will be active during this time period with the sole purpose of giving as many QSOs as possible to other amateurs worldwide. This activity is not meant to be a contest, but rather a weekend set aside to give DXers and awards chasers a chance at working relatively rare Hong Kong. The Hong Kong Amateur Radio Transmitting Society offers two very attractive awards, with the income from the awards helping to finance the VS6 QSL Bureau.

The *Nine Dragons Award:* One QSO with a country in each of the following 9 zones—18, 19, 24, 25, 26, 27, 28, 29, and 30. The zone 24 QSO must be with a VS6 station. Stations within the 9 zones require 2 QSOs in each zone and 2 VS6s. QSOs after January 1, 1979, are accepted. Award fee is $3 US or 25 IRCs. Certified log extracts should be sent; please do not send QSLs.

Firecracker Award: Six QSOs with different VS6s. QSOs must be after January 1, 1964. Award fee is $2 US or 15 IRCs. Send certified log extracts.

CALENDAR

Apr 3-4	**CW & RTTY World Championships**
Apr 10-11	**CARF Phone Commonwealth Contest**
Apr 17-18	**ARCI QRP Spring QSO Party**
Apr 24-25	**YL ISSB QSO Party—Phone**
May 1-2	**County Hunters SSB Contest**
May 15-17	**Michigan QSO Party**
Jun 12-13	**ARRL VHF QSO Party**
Jun 12-13	**Worldwide South America CW Contest**
Jun 26-27	**ARRL Field Day**
Jul 10-11	**IARU Radiosport**
Jul 17-18	**International QRP Contest**
Aug 7-8	**ARRL UHF Contest**
Aug 14-15	**European DX Contest—CW**
Sep 11-12	**ARRL VHF QSO Party**
Sep 11-12	**European DX Contest—Phone**
Oct 16-17	**ARCI QRP CW QSO Party**
Nov 6-7	**ARRL Sweepstakes—CW**
Nov 13-14	**European DX Contest—RTTY**
Nov 20-21	**ARRL Sweepstakes—Phone**
Dec 4-5	**ARRL 160-Meter Contest**
Dec 11-12	**ARRL 10-Meter Contest**

Applications for either award should be addressed to the Hong Kong Amateur Radio Transmitting Society (HARTS), PO Box 541, Hong Kong. As many of their members have QSL managers, you are urged to QSL via the managers and not through the VS6 bureau if at all possible!

CARF PHONE COMMONWEALTH CONTEST

Starts: 1200 GMT April 10
Ends: 1200 GMT April 11

All entrants may use the full 24-hour contest period. All radio amateurs licensed to operate within the Commonwealth or British Mandated Territories are eligible to enter. Use SSB only on the 80- through 10-meter bands. Only one contact may be claimed with a specific station on any one band, and duplicate contacts must be clearly marked as such without claim for points. Contacts may be made with any station using a Commonwealth callsign except those within the entrant's own call area. UK stations may not work each other for points.

EXCHANGE:

A contact consists of an exchange and acknowledgement of an RS report and a three-figure serial number starting at 001 and increasing by one for each successive contact throughout the contest period. Do not send a separate series of serial numbers on each band.

FREQUENCIES:

3600, 3780, 7080, 14180, 21200, 28480.

SCORING:

Each completed contact will score 5 points. In addition, a bonus of 20 points may be claimed for the first, second, and third contacts with each Commonwealth call area on each band.

AWARDS:

The CARF Phone Commonwealth Contest Plaque will be awarded to the top scoring entry in the multi-band class. Certificates will be awarded to top scoring entrants in each class in each Commonwealth call area.

ENTRIES:

Separate logs are required for each band. Each band log should be separately totaled and should include a checklist of call areas worked on that band. Logs should include, for each contact: time in GMT, callsign of station worked, exchange sent and received, points claimed. Separate band totals should be added together and total claimed score entered on a summary sheet.

Entries may be multi-band or single-band. Single-band entries should show contacts for one band only. Only single-operator entries will be accepted. Single-operator entries are manned by one operator only who receives no assistance whatever during the contest period. Multi-band entries are not eligible for single-band awards. Each entry will consist of the separate band logs, call area checklists, a summary sheet, and dupe sheets. Entries should be addressed to: CARF Contests & Awards Committee, PO Box 2172, Station D, Ottawa, Ontario, K1P 5W4 Canada. Under no circumstances should entries for the CARF Phone Commonwealth Contest be sent via the RSGB, nor should entries for RSGB's CW Contest be sent via CARF. The closing date for entries will be June 1st. Official summary sheets are available for an SASE.

QSL OF THE MONTH: W7ON

W7ON believes the best QSL is the simple QSL that instantly communicates a great deal about your station's location. The green saguaro cactus is the symbol of his Arizona QTH; it stands against a desert sand brown wood grain of desert pine. His call letters and address were chosen to be in a brown western font and placed off center to balance the image. The backside is filled out using brown ink to further the desert, dry, barren idea.

If you would like to enter our contest, put your QSL card *in an envelope* and mail it, along with your choice of a book from *73's* Radio Bookshop, to *73 Magazine*, Pine Street, Peterborough NH 03458, Attention: QSL of the Month. Entries which do not use an envelope (the Postal Service does *occasionally* damage cards) and do not specify a book will not be considered.

QRP ARCI SSB QSO PARTY

Starts: 1200 GMT April 17
Ends: 2400 GMT April 18

Participants may operate a maximum of 24 hours during the contest period. Stations may be worked once per band for QSO and multiplier credits.

EXCHANGE:

Members—RS, state/province/country, and QRP number.

Non-members—RST, state/province/country, and power input.

SCORING:

Each member QSO counts 5 points regardless of location. Each non-member US or Canadian contact counts 2 points. Non-members outside W/VE count 4 points. Multipliers are as follows: 8-10 Watts pep output—×2, 6-8 Watts—×4, 4-6 Watts—×6, 2-4 Watts—×8, and less than 2 Watts—×10.

Stations running on more than 10 Watts pep output will count as check logs only. Bonus multiplier is ×2 if 100% natural power (solar, wind, etc.) with no storage or ×1.5 if 100% battery power. Final score is total QSO points times total number of states/provinces/countries per band times the power multiplier times the bonus multiplier (if any).

FREQUENCIES:

1810, 3985, 7285, 14285, 21385, 28885, 50385. All plus or minus to clear interference. VHF/UHF contacts must be direct and not through a repeater.

AWARDS:

Certificates to the highest scoring station in each state, province, or country with two or more entries. Entries are automatically considered for annual Triple Crowns of QRP Award.

LOGS & ENTRIES:

Send large SASE to contest chairman for scoring summary sheet in advance of contest. Separate log sheets are suggested for each band for ease in scoring. Send full log data plus separate work sheet showing details and time(s) off air. No log copies will be returned. All entrants desiring results and scores please include a no.10 envelope with enough US postage for one ounce or an IRC. It is a condition of entry that the decision of the contest chairman of QRP ARCI is final in case

Metroplex

in NJ 201/592-1579

Amateur Communications Association Inc
Box 237, Leonia, New Jersey 07605

NEWSLETTER CONTEST WINNER

This month's winner is published by the Metroplex Amateur Communications Association, a large repeater-oriented group based in northern New Jersey. Editor WA2OVG is a commercial designer, and his influence clearly shows. The Metroplex newsletter is beautifully designed, with excellent layout and classy typography. A newsletter that looks good not only attracts readers, but also catches the eye of potential advertisers. With over a page and a half of advertising in a six-page issue, Metroplex is able to cover a large percentage of the cost of the newsletter without undue drain on the club's treasury.

The moral of the month is: Utilize the talents of your members. If you have a printer, commercial artist, journalist, or photographer in your club, try to convince him to donate some of his time and talent to the cause. A club's greatest asset is its members—don't let their talents go to waste.

of dispute. Logs must be received by May 20th. Logs received after that date or missing information will be used as check logs. Send logs and scoring information to: QRP ARCI Contest Chairman, William W. Dickerson WA2JOC, 352 Crampton Drive, Monroe MI 48161.

ARBOR DAY CELEBRATION

Starts: 2400 GMT April 23
Ends: 0600 GMT April 26

A special events station will be operating from the Nebraska State Arbor Lodge, former home of J. Sterling Morton, founder of Arbor Day, in Nebraska City, Nebraska, during the annual Arbor Day Celebration. This station, in addition to other club member stations, will be operating in the General portion of the phone and CW bands on 80 through 10 meters. All amateurs contacting this station or any other club member station during this time will be eligible to receive an Arbor Day commemorative certificate from the Nebraska City Amateur Radio Club. Please send one dollar and a business-size self-addressed envelope to: John A. Royal WØGRB, PO Box 146, Nehawka NE 68413.

YL ISSB QSO PARTY—PHONE

Starts: 0001 GMT April 24
Ends: 2359 GMT April 25

Two six-hour rest periods are required. Operating categories include: single operator, DX/WK teams, and YL/OM teams. All bands will be used and the same station may be contacted on different bands for contact points but not as country multipliers. Two meters may be used, but contacts must be direct and not through repeaters.

EXCHANGE:

Name, RS, SSBer number, country, state, and partner's call. If no partner, leave blank. If non-member, send "NO NUMBER."

SCORING:

Score five points for each member contacted on any continent. Non-member contacts count one point. Only member station contacts count for multipliers. Multipliers are each state, country, and province, and also each team contacted, but only once for each team. When DX/WK partners contact each other, it counts as a double multiplier. Final score is sum of QSO points times the total multiplier.

ENTRIES:

Logs must show date/time (GMT), RS, SSBer number, partner's call, mode of operation, band, and period of rest time. Summary sheets show number of states, Canadian provinces, countries, YL/OM teams, DX/WK teams, and partner contacts. Send logs, summary sheets, and completed YL ISSB QSO Party applications to Minnie Connolly KAØALX, Star Rt. #1, Crocker MO 65452. Anyone needing blank forms or additional information, send an SASE to the above address.

RESULTS

RESULTS OF THE 1981 CARF PHONE COMMONWEALTH CONTEST

Class	Callsign	Score	QSOs	Bonus	Place
A	VE1ASJ	6360	544	182	1
A	G3FXB	5740	448	175	2
A	VE5RA	5730	482	166	3
A	VE3GCO	5180	396	160	4
A	VP2VGR	4130	390	109	5
A	VE5BBD	2915	227	89	6
A	G4APL	2465	129	91	7
A	VE2ZP	2395	139	85	8
A	VK7BC	2245	113	84	9
A	VK6FS	2160	136	79	10
A	VE3UD	1685	117	55	11
A	VE4RP	1375	103	43	12
A	G3ZRL	815	59	26	13
A	VE3KFZ (op. VE3HWS)	605	30	23	14
A	VE3GWM	305	13	12	15
14	VE3KKB	1440	96	48	1
14	GW3MPB	390	18	15	2

How the leaders made their scores: QSOs versus bonus point QSOs broken down by band.

Band	3.5	7	14	21	28 MHz
VE1ASJ	13/12	26/14	83/47	110/41	312/68
G3FXB	4/4	16/12	155/61	140/51	133/47
VE5RA	1/1	30/25	120/52	80/29	251/59
VE3GCO	7/6	15/15	195/67	54/25	125/47
VP2VGR	—	—	115/39	53/28	222/42

COUNTY HUNTERS SSB CONTEST

Contest Periods:

0001 to 0800 GMT May 1
1200 GMT May 1 to 0800 GMT May 2
1200 to 2400 GMT May 2

Please note the two 4-hour rest periods.

Mobiles may be worked each time they change counties or bands. Mobiles that are worked again from the same county on a different band count for point credit only. Mobiles that are contacted on a county line count as one contact but 2 multipliers. Fixed stations may be worked by other fixed stations only once during the contest. Repeat QSOs between fixed stations on other bands are not permitted. Fixed stations may be worked by mobiles each time they change counties or bands. Repeat contacts between mobiles are permitted provided they are on a different band or county. Mixed mode contacts are permitted provided that one station is on SSB. Contacts made on net frequencies will not be allowed for scoring in this year's contest.

EXCHANGE:

Signal report, county, and state or country.

FREQUENCIES:

Suggested frequencies are as follows: 3920-3940, 7220-7240, 14275-14295, 21375-21395, 28625-28650.

There will be a "Mobile Window" of 10 kHz on the following frequencies: 3925-3935, 7225-7235, 14280-14290. Mobiles will be in this 10-kHz segment and fixed stations are asked to refrain from calling "CQ CONTEST" in the mobile window. After working mobiles in the window, fixed stations are requested to QSY outside the window to work fixed stations in the contest. This will allow the mobiles running lower power a chance to be heard and worked in the contest. There will be a special effort to work DX on 28.636 by mobiles.

SCORING:

Contact with a fixed US or Canadian station = 1 point. Contact with a DX station (KL7 and KH6 count as DX) = 5 points. Mobile contacts = 15 points. Multiplier = total US counties + Canadian stations. Score = multiplier x total QSO points.

AWARDS:

MARAC plaques to the highest scoring fixed US or Canadian station, DX station, and 2 top-scoring mobile stations. Certificates to the top 10 fixed and mobile stations in the US and Canada and to the highest scoring station in each DX country.

ENTRIES:

Logs must show date and time, station worked, reports exchanged, county, state, band, claimed QSO points (1, 5, or 15), and each new multiplier must be numbered. Logs and summary sheets are free for a #10 SASE or SAE and appropriate IRCs. Write to: John Ferguson WØQWS, 3820 Stonewall Ct., Independence MO 64055.

All entries must be received by June 15th to be eligible for awards. DX entries should use air mail. Winners will be announced at the 1982 Independent County Hunters Convention during July and in the MARAC *Newsletter.*

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

NOVICES TO NOVICE

Novices, take heart—here is a mini-expedition for you! Beginning April 17th at 1800 Zulu and continuing until 1800 Zulu on the 18th, the North Texas High-Frequency Association will be operating the Novice bands from Novice, Texas. Look for the mini-expedition about the center of the Novice bands, signing the call KC5YN (Young Novice). Operators will work your calling speed (if you're not too fast), so don't worry about calling. A commemorative QSL will be issued to all stations worked who send a legal-sized SASE.

The NTHFA is the same group that brought you "Phone From Telephone, Texas," the "Alternate Olympics" from Moscow, Texas, and the annual mini-expedition from the decks of the Battleship *Texas*, moored in the Houston ship channel.

We look forward to working you, Novice or not, from Novice, Texas; remember to "Keep Calling Five Young Novices."

SOUTH EAST QUEENSLAND TELETYPE GROUP AWARD

This award is open to all transmitting and listening amateurs. Australian amateurs must score 5 points; overseas amateurs must score 3 points.

To qualify, a station must, where possible, copy the official station of the South East Queensland Teletype Group, VK4TTY, during a news broadcast, and, in the case of a transmitting amateur, participate in the call-back (2 points). A portion of the printout of the news broadcast together with the date, time, frequency, and broadcast number are to accompany the request for the award.

Additionally, a transmitting amateur must work three member stations of the SEQTG on RTTY (1 point each). Log extracts and/or printouts are to be included with the award application, and each member station may be counted only once towards the award.

Listening amateurs should, in lieu of (b), forward log extracts and/or printouts of three contacts involving different member stations of the SEQTG (1 point each).

Applicants for the award should forward the above information together with one dollar Australian or 5 IRCs to cover postage and printing costs, to: the Secretary, SEQTG, PO Box 184, Fortitude Valley, QLD 4006, Australia.

MARCCO AWARDS

The Mobile Amateur Radio Club of Colorado (MARCCO) is an organization of licensed amateur radio operators who engage in HF mobile operations. Meetings are held at noon on the first Friday of every month at Wyatt's Cafeteria, Cherry Creek Shopping Center, Denver. Visiting mobilers are invited to attend the monthly meetings whenever they are in Denver.

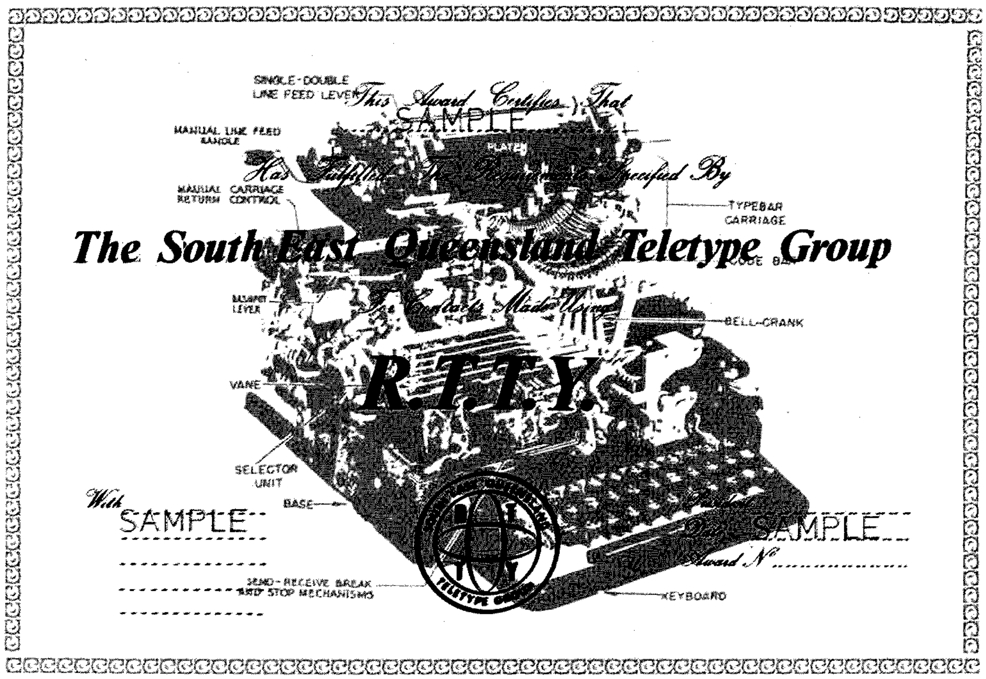
Current MARCCO officers are J.D. Jones WBØBNP, president, Rich High WØHEP, vice president and awards chairman, Paul F. Hultquist WBØSEQ, secretary/treasurer, and John S. Seale, Jr. KDØU, nominating committee chairman.

MARCCO has established several awards effective January 1, 1981. Among them are:

- WACCO Award—Worked mobiles in all Colorado counties.
- Border-to-Border and Coast-to-Coast Awards—Worked mobiles in an unbroken string of counties from Canada to Mexico or from the Atlantic Ocean to the Pacific Ocean. Any string must contain at least three Colorado counties.
- WAMTZ Award—Worked mobiles in all counties in the Mountain Time Zone.

As a gesture of respect and affection for the late Bing Miller WØGV, a charter member of MARCCO, the club will continue the Worked All Bingo award he established for working in all Colorado counties. It will be called the WØGV Memorial Award and will be given for working the same mobile in each of the 63 Colorado counties. Persons who already have worked Bing in one or more Colorado counties, regardless of date, may combine these contacts with those obtained from any other *single* mobile in the remaining counties to qualify for the award.

Log information is sufficient for all MARCCO awards.



For more information concerning awards, contact Rich High WØHEP, MARCCO Awards Chairman, 451 East 58th Avenue 239B, Denver CO 80216; telephone (303)-595-9286.

WORKED ITALIAN ISLANDS AWARD

The WIIA, formerly issued by the DX Old Timers Club (DXOTC), was discontinued when the club ceased its activity. The award has now been resumed by ARI. The new award series will start with number 101.

Scope: The award is issued in order to promote activity from islands belonging to Italy and, especially, from minor islands.

Mode: The award will be issued for 2xCW, 2xSSB, and 2xRTTY. No cross modes or mixed modes are allowed. The award is also available for SWL with no mode restrictions.

Bands: Contacts (or heards) can be made on any band between 3.5 and 29.7 MHz, including those allocated by WARC '79 as soon as they are officially allowed in Italy.

Validity: Contacts (or heards) made on January 1, 1982, or after will count for this award.

Contacts: The award will be issued for contacts (or heards) with not fewer than 10 islands or island groups according to the following list: Tuscan Archipelago IA5, Ponziane Islands IBØ, Neapolitan Archipelago IC8, Eolie (or Lipari) Islands ID9, Island of Ustica IE9, Egadi Islands IF9, Pelagic Islands (Lampedusa, etc.) IG9, Island of Pantelleria IH9, Cheradi Islands IJ7, Tremiti Islands IL7, Minor Islands surrounding the Island of Sardinia IMØ, Sardinia Island ISØ, Sicily Island IT9, for a total of 13. A special endorsement will be mentioned in the award if all 13 islands are contacted (or heard).

In order to be credited for the award, contacts (or heards) shall be made with stations permanently located on an island or island group. Credit also will be given for contacts (or heards) made with stations operating temporarily from such locations. These stations shall identify themselves by using their regular call followed by the prefix assigned to that specific island or island group.

Application: Applications shall include all data regarding contacts (or heards) made. Applicant's name and address should be in block letters and should be forwarded with OSLs or other type of written confirmation of the contacts (or heards) made together with 3 US dollars or 10 IRCs to: ARI Award Manager, G. Nucciotti I8KDB, Via Francanzano 31, 80127 Napoli, Italy.

GCR will not be accepted.

PONY EXPRESS DAY

The Missouri Valley Amateur Radio Club will hold its third annual Pony Express Day on April 10, 1982, from 1000 to 1900 CST. The event commemorates the original running of the Pony Ex-

73 MAGAZINE AWARDS PROGRAM

Work the World Award

97 WD6DFN	98 KN4F	99 WA2WRD
100 N8BDI	101 WB9NOV	102 KA3DBN
103 K9GHP	104 WØYBV	105 KA7GIN
106 W8HTM	107 N6ATS	108 KC5TK
109 K3STM	110 9G1RT	111 WA2LYF
112 ZS6ABA	113 VK2HD	114 VE3LVN
115 VE1ACK	118 PY2BTR	117 VE3JPJ
118 HC2RG	119 WA9IVU	120 VK2NHV

North American Award

154 WD6FDN	155 KØUKO	156 W8UMP
157 N8BDI	158 K3WUR	159 WB8PRK
160 WA2WRD	181 KN4F	162 KA3FUU
163 W7HAZ	184 WB4PHW	165 WA9IVU
166 WA9AHZ	167 WB9NOV	168 AK5G
169 KG9O	170 K9GHP	171 WB7WQB
172 WBØCHS	173 KA7GIN	174 W8HTM
175 AL7O	176 DFH-1000742	177 KB2WH
178 VE3MAM	179 WA1UDH	180 KA1UA
181 AG7P	182 WA8KMK	183 K9IML
184 N6ATS	185 WD4JEQ	186 K3STM
187 N3ALL	188 WN8GUE	189 DA1AS
190 OE2-207181	191 KA8JHD	192 WD9IBM
193 N3AKQ	194 9G1RT	195 KL7ISO
196 AKØG	197 OK-DR1239	198 ZS6ABA
199 W8VUZ	200 VK2HD	201 HC2RG
202 KA2MIM	203 VE3JPJ	204 SV1GJ
205 PY3BTR	206 VE1ACK	207 VE3LVN
208 KA5BQM	209 KB8WJ	210 WD9EPV
211 VK2NHV	212 KC3W	

South American Award

137 WD6DFN	138 KN4F	139 WA2WRD
140 WB8PRK	141 K3WUR	142 N8BDI
143 WB7WOB	144 K9GHP	145 AK5G
146 WB9NOV	147 WA9IVU	148 W7HAZ
149 KA3FUU	150 W8HTM	151 KA7GIN
152 KG9O	153 WD4JEQ	154 N6ATS
155 K9IML	156 WA8KMK	157 AG7P
158 PY1DWM	159 WA1UDH	160 N3AKQ
161 KA8JHD	162 PY2TTV	163 PY2RHL
164 N3ALL	165 K3STM	166 WD9IBM
167 W8VUZ	168 ZS6ABA	169 AKØG
170 KL71SO	171 9G1RT	172 VE3LVN
173 VE1ACK	174 AL7O	175 KB2WH
178 PY2BTR	177 PY2AJK	178 SV1GJ
179 VE3JPJ	180 KA2MIM	181 HC2RG
182 VK2HD	183 KC3W	184 WDØAVG
185 VK2NHV		

Asian Award

109 WD6FDN	110 OE2-207181	111 DFH-1000742
112 KN4F	113 WA2WRD	114 K3WUR
115 N8BDI	116 K9GHP	117 WB9NOV
118 KA3DBN	119 W7HAZ	120 KA3FUU
121 W9YBV	122 W8HTM	123 KA7GIN
124 AI7O	125 N6ATS	126 KC5TK
127 K3STM	128 W8VUZ	129 ZS6ABA
130 VK2KEW	131 OK-DR1239	132 9G1RT
133 WA2LYF	134 VE3LVN	135 VE1ACK
136 WA9IVU	137 PY2BTR	138 VE3JPJ
139 HC2RG	140 VK2HD	141 VK2NHV

African Award

120 WD6FDN	121 N8BDI	122 W1SIX
123 K3WUR	124 WA2WRD	125 KN4F
126 DFH-1000742	127 KA3FUU	128 WA9IVU
129 WB9NOV	130 K9GHP	131 WB3BVL
132 OE2-207181	133 KC5TK	134 KA7GIN
135 W8HTM	136 K9IML	137 WØYBV
138 KA1UA	139 N6ATS	140 WD4JEQ
141 K3STM	142 OE6CTG	143 PY2RHL
144 N3ALL	145 WA8KMK	146 9G1RT
147 OK-DR1239	148 ZS6ABA	149 W8VUZ
150 VK2HD	151 HC2RG	152 8P6OV
153 VE3JPJ	154 PY2BTR	155 KB2WH
156 VE1ACK	157 VE3LVN	158 KC4YY
159 VK2NHV		

European Award

176 OE2-207181	177 WD6DFN	178 DFH-1000742
179 KA9ENM	180 W8UMP	181 N8BDI
182 K3WUR	183 WB8PRK	184 WB9KUV
185 WA2WRD	186 KN4F	187 KA3FUU
188 W7HAZ	189 WB9PNW	190 W9NTU
191 W9NTU	192 WA9IVU	193 KA6EBE
194 WB9NOV	195 AK5G	198 K9GHP
197 WB7WOB	198 W9CC	199 KB2WH
200 KL7NX	201 AI7O	202 VE7ADA
203 KG9O	204 KA7GIN	205 W8HTM
206 WA1UDH	207 KA1UA	208 KA2JDP
209 PY1DWM	210 AG7P	211 WA8KMK
212 OZ5EDR	213 WD9INF	214 KH6DRT
215 PY3CJS	216 N6ATS	217 4Z4VG
218 N8CJF	219 WD4JEO	220 K3STM
221 N3ALL	222 PY2RAN	223 PY2RHL
224 PY2ITO	225 PY2DJC	226 DA1AS
227 KA2JJK	228 DU1CPL	229 PY2TTV
230 KA8JHD	231 WD9IBM	232 9G1RT
233 PY1EWN	234 KL7ISO	235 AKØG
236 OK-DR1239	237 VK2KEW	238 ZS6ABA
239 W8VUZ	240 VK2HD	241 HC2RG
242 KA2MIM	243 PY1BVY	244 VE3JPJ
245 PY2AJK	246 PY2BTR	247 VE1ACK
248 VE3LVN	249 KC3W	250 VK3NHV

Oceanic Award

108 WD6FDN	109 KN4F	110 WA2WRD
111 N8BDI	112 AK1H	113 K9GHP
114 AK5G	115 WB9NOV	116 DF9ZP

press from St. Joseph, Missouri, to Sacramento, California. This year the Club also will help the City of St. Joseph celebrate the 100th anniversary of the death of the outlaw Jesse James. This will be accomplished by offering along with the Pony Express certificate a wanted poster of Jesse James.

Anyone making contact with the Club station, WØNH, is eligible to receive both certificates. The operating frequencies will be 10 kHz from the bottom of the General phone bands on 15, 20, 40, and 75 meters. On 10 meters, the frequency will be 28.575. The CW bands will be 28.150 on 10 meters, 21.150 on 15 meters, and 7.125 on 40 meters.

All that is necessary to receive both certificates is to send two first class postage stamps and a QSL card to the Missouri Valley Amateur Radio Club, 401 N. 12th Street, St. Joseph MO 64501.

ALGOA BRANCH AWARD

This award is available free of charge to amateurs throughout the world.

Amateurs outside zone 38 must make at least ten contacts with Algoa Branch members on at least three different bands. Only one contact per branch member per band will count. A sticker for each extra band will be supplied on application, with proof of contact. All contacts must be made subsequent to the formation of the Algoa Branch on April 14, 1979.

A copy of the log or full details of contacts must accompany the application to: The Awards Manager, Algoa Branch Award, PO Box 10050, Port Elizabeth 6015, Republic of South Africa.

Algoa Branch members are as follows; those with the asterisk are members known to be active on the DX bands.

ZS2AP	*ZS2JS	*ZS2RB
ZS2AR	ZS2KU	ZS2RG
ZS2BE	ZS2LM	ZS2RH
*ZS2BS	ZS2LN	*ZS2RN
*ZS2C	ZS2MD	ZS2RR
ZS2CC	ZS2MF	*ZS2SI
*ZS2DJ	*ZS2MG	*ZS2SP
*ZS2DK	*ZS2NC	*ZS2U
*ZS2EK	ZS2NH	ZS2UI
*ZS2HU	ZS2OC	ZS2W
ZS2JC	ZS2OD	*ZS2WG
ZS2JE		

U.S.S. NORTH CAROLINA

The Azalea Coast Amateur Radio Club will be operating from the battleship *U.S.S. North Carolina*, Wilmington NC, on April 17 and 18 from 0830 to 1800 EST. The operating frequencies will be 25 kHz up from the lower edge of the General class phone band.

Please QSL to the Azalea Coast Amateur Radio Club (WD4ORA), PO Box 4044, Wilmington NC 28406, and include an SASE.

ALAMO DXPEDITION

The Border Amateur Radio Society and the Uvalde Radio Club will hold their annual Alamo Village DXpedition on the weekend of April 17-18. W5LFG will be working all bands on

117 KA3DBN	118 W7HAZ	119 W8HTM
120 KA7GIN	121 WØYBV	122 K9IML
123 AL7O	124 KC5TK	125 WD4JEQ
126 WA9VU	127 N6ATS	128 KH6JJC
129 KH6DRT	130 AG7P	131 OE2-207181
132 K3STM	133 ZS6ABA	134 VK3KEW
135 KL7ISO	136 9G1RT	137 VE3LVN
138 VE1ACK	139 PY2BTR	140 VE3JPJ
141 WB6SZZ	142 HC2RG	143 VK2HD
144 VK2NHV		

DX Country Club Award

2×SSB

75 WD6FDN	76 8P6OV	77 KN4F ('79)
78 KN4F ('80)	79 WA9IVU	80 W7HAZ
81 K9IML	82 AG7P	83 KA1UA
84 N6ATS	85 KE7C	86 KA3FUU
87 VK2HD ('79)	88 VK2HD ('80)	89 VK2HD ('81)
90 9G1RT	91 SV1GJ	92 WA8KMK
93 VK2NHV	94 CT2CQ	95 HC2RG

2×CW

1 AA8Z	2 W7ULC	3 SM5AKT
4 WD8MAS	5 WB7PKD	6 WØYBV
7 WB2FFY	8 WB3BVL	9 WB9UIA
10 WB9UIA	11 VE1BWP	12 KA2EAO
13 VE1ACK	14 KC3W	

DX Capitals of the World

12 WA2SRM	13 WA2YEX	14 DF7DQ
15 VK6YL	16 OE8MOK	17 8P6OV
18 N6ATS	19 VK2HD	20 ZS6ABA
21 SV1GJ	22 VE1ACK	

10-Meter DX Dacada Award

1 WB4WRE/M	2 AC3O	3 W5TJO
4 WDØAVG	5 DA2AL	6 WB4TZA
7 WD5JRG	8 WA4ZLZ	9 WB8LSV
10 WB9WFZ	11 W8AKS/6	12 KA3FUU

Specialty Communications Award

Class A—Work All States

1 WA6VGS (Via OSCAR 8 Satellite)
2 KE7C (Via RTTY)

Class A1—Over 10 DX Countries

1 W2ODA	(RTTY)	2 WBØQCD	(SSTV)
3 WB7BFK	(RTTY)	4 WBØQCD	(RTTY)
5 WD9GRI	(RTTY)	6 WB6CDM	(RTTY)
7 N3AKO	(RTTY)	8 OU1EFZ	(RTTY)
9 K3WUR	(RTTY)	10 WB2VTD	(RTTY)
11 PY3CJS	(RTTY)	12 KE7C	(RTTY)
13 AL7O	(RTTY)	14 PY1EWN	(RTTY)
15 OE1PBA	(RTTY)		

Worked All USA Award

Mixed Band

54 N7CPE	55 KA3GSN	56 KA3FUU
57 KA4VNS	58 AG7P	59 N8CJF
60 KA5EEZ	61 KA7JNP	62 WA9IVU
63 8P6OV	64 KA7CPZ	65 AKØG
66 VE3JPJ	67 HC2RG	68 KAØJTT
69 KA2MIM		

6 Meters

1 WBØZKG	2 K6PHE	3 N4BJJ
4 KA5DDE	5 WB5SND	6 K3HFV
7 N4QH	8 N5DDB	

10 Meters

1 KL7IEN	2 W5ZKJ	3 VE1BVD
4 JH8DSC	5 VK7NBT	6 VE1BWP
7 N4QH		

15 Meters

1 WD5DRB	2 WAØCEL	3 KA6ACO
4 WB6CDM	5 KA4IFF	6 WB9UKS
7 N4QH	8 WB7VBQ	

20 Meters

6 WB9UKS	7 VK6YL	8 N8BDI
9 N4QH	10 KAØBOS	3 KA5AOP
4 KS4B	5 WB9UKS	6 KB5FN
7 WAØRVK	8 N4QH	9 W4PCK

160 Meters

1 KC8P

District Endurance Award

5 WA4ZLZ	(54 min.)	6 GI4KCE	(8.3 min.)
7 WA2MCE	(54 min.)	8 XE1TIS	(49 min.)
9 KØWNY	(52 min.)	10 KE7C	(14 min.)
11 KA3FUU	(50 min.)	12 SV1GJ	(42 min.)

Century Cities Award

Work 100 Cities in 50 US States

23 KC9CA	24 N8CJF	25 KE7C
26 AKØG	27 WB7VBVQ	

Q5 Award of Excellence

61 N7CPE	62 N8BDI	63 KA7EII
64 W8UPD	65 KA2IOJ	66 WB9KUV
67 KA5KKZ	68 KA9ENM	69 PY2UGS
70 KA3FUR	71 KA6JQB	72 KA7CPZ
73 KA1DJB	74 KA3GSN	75 WB9HPR
76 W4PCK	77 KA4LSJ	78 KA4LSJ
79 KA3FUU	80 N1BDB	81 KP4FCK
82 KA2MIM	83 W1DWA	84 KA2MMM
85 KA7JNP	88 WA2AKX	87 KP4ERH
88 KA8CUS	89 KA4VNS	90 N8CJF
91 WDØEPV	92 KB8WJ	93 KAØJTT
94 KA5KOS		

phone and CW. There will be certificates given to amateurs who work them and send an SASE (8" x 10" mailer). We promise 100% QSL to those meeting these requirements.

Alamo Village, a complete reconstructed western town open to tourists and located a few miles outside of Brackettville, is the movie-making capital of Texas. it was the site of the filming of *The Alamo* with John Wayne and *Bandelero* with Dean Martin, as well as many others. The local amateurs will be working out of such sites as the Cantina, Jailhouse, and even a construction of the Alamo itself.

FIRST BRIDGE OVER THE MISSISSIPPI

The Quad Cities Amateur Radio Club, Rock Island, Illinois, will operate special events stations in commemoration of the first bridge across the Mississippi River, which was a significant development in the opening up of the western United States.

W9YCR will be on the air from 1800 hours UCT (noon CST) Saturday, April 17, through 1800 hours UCT, Sunday, April 18, on the 80- through 10-meter bands on the following frequencies: in the middle of the Novice CW portion of each Novice class band, as low in frequency as possible in the General CW portion of each band and 30 kHz up from the lower edge of the General SSB portion of each band.

QSL via Denny Spurgeon N9BKY, 413 23rd Avenue, Moline IL 61265—and please enclose a business-size SASE for a commemorative certificate.

The Quad Cities is a three-county area surrounding Rock Island and Moline, Illinois, and Davenport and Bettendorf, Iowa. It is the farm implement manufacturing capital of the world, the largest metropolitan area in Iowa and Illinois outside of Chicago, and boasts over 1,000 amateur radio operators.

SUN-DAY

The Indian River Amateur Radio Club (IRARC) will participate in a "Sun-Day" exercise in conjunction with the Florida Solar Energy Center at Cape Canaveral, Florida, on Friday, May 7, and Saturday, May 8, 1982.

The IRARC station will be using the Club call, W4NLX/4, and at that time will be operating completely on solar power.

The hours, frequencies, and mode of operation on both days are as follows:

- 1300 to 1400 GMT, 40 meters, 7,250 to 7,275 kHz, SSB.
- 1400 to 2000 GMT, 15 meters, 21,350 to 21,375 kHz, SSB.

A certificate confirming contact or reception will be issued free to each station or short wave listener who sends a QSL and an SASE (foreign—1 IRC) to: Florida Solar Energy Center, Attention: "Sun-Day," 300 State Route 401, Cape Canaveral FL 32920.

ARMED FORCES DAY

This year's observance of Armed Forces Day marks the 33rd anniversary of communications tests between the amateur radio fraternity and military communications systems. The proceedings will include operations on CW, SSB, RTTY, and SSTV.

Special commemorative QSL cards will be awarded to amateurs achieving a verified two-way radio contact with any of the participating military radio stations. Those who receive and accurately copy the Armed Forces Day CW and/or RTTY message from the Secretary of Defense will receive a special commemorative certificate.

Military-to-amateur cross-band operations will be conducted from 1300 UTC May 15 to 0245 UTC May 16. Military stations will transmit on selected military frequencies and listen for stations on a particular amateur frequency specified by the military operator.

Transcriptions of the CW or RTTY receiving tests should be submitted "as received." Submissions should include time, frequency, and the call letters of the military station copied as well as the receiving station's name, callsign, and address on the submitted copy.

Entries must be postmarked no later than May 22, 1982, and be submitted to the appropriate command: NAM, NPG, or NAV entries go to Armed Forces Day Test, Navy-Marine Corps MARS, 4401 Massachusetts Ave. NW, Washington DC 20390. Send WAR submissions to Armed Forces Day Test, Commander 7th Signal Command, ATTN: CCN-PO-OR, Fort Ritchie MD 21719. Send AIR entries to Armed Forces Day Test, 2045th CG/DONJM, Andrews AFB DC 20331.

SMALLEST QTH?

Neffs Area Amateurs (Belmont County) will operate WB8TQG, the smallest ham radio shack in Neffs, Ohio, and perhaps in the world. Work us and let us know if you have a smaller one!

Times: 1600Z May 29 to 2200Z May 30.

Frequencies: Phone—146.46, 28.610, 21.410, 14.340, 7.265, and 3.965; CW—28.120, 21.120, 7.120, and 3.720.

Certificate for QSL card and business SASE to Floyd WB8TQG, PO Box E, Neffs OH 43940.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time away from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print (neatly!), double spaced, your request on an 8½" x 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I will pay up to $25 each, including postage, for an original or a copy of an instruction manual and schematic for a Gertsch Model FM-3 frequency meter and an RCA type 710 UHF signal generator.

D. S. Toomb N6AFO
841 W. Tenth St.
Claremont CA 91711

I need service manuals for RCA mobile 450-470 MHz transceiver models CLUE BT2 FH and CMUE BT2 FH. Costs for copying or other costs will be reimbursed promptly.

John S. Hoff KA6HRK
15500-A Williams St.
Tustin CA 92680

I would like to obtain an operating manual and schematic diagram for a National NC300 receiver. I will pay any copying costs.

Tom Race
2104 Claremont Terrace
Utica NY 13501

I am in need of a schematic and instruction manual for a Sorensen ac voltage regulator, Model 1000-S.

Mike Pellock NA6J
4955 School House Rd.
Catheys Valley CA 95306

Does anyone have information about a Teletype oscilloscope (Model OS-11/FGC-5) or a Collins military receiver/transmitter (Model RT-441/TRC-68) for the 225-400-MHz band?

Daniel S. Durgin KA1AFJ/8
121 Lake St.
Uhrichsville OH 44683

I need manuals and schematics for Tektronix Model 532 and 545 oscilloscopes, as well as the associated plug-in amplifiers. I will pay for postage and copying.

Larry Beall WA5TUQ
1333 Edgewood
Lufkin TX 75901

I am looking for six-meter conversion information for a General Electric transmitter-receiver unit MT-16u, issue O, option AT2, serial AL 4129.

Noel P. Larson WØCXR
Star Rt. Box 489A
Merrifield MN 56465

Does anyone have an interest in or experience with using microwave oven magnetrons for service in the 2300-MHz amateur band?

Phil Chadwick W3GMK
Route 2
New Hope PA 18938

CORRECTIONS

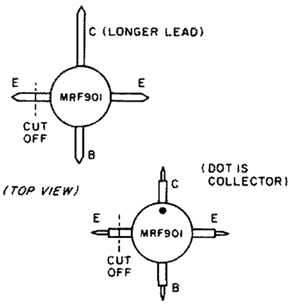


Fig. 1. Pinout diagram for "Amateur Television's Stripper."

"Amateur Television's Stripper" (March, 1982) uses an MRF901 transistor. Several varieties are available, and the accompanying pinout diagram (Fig. 1) may be helpful to readers attempting to duplicate this project.

Tim Daniel N8RK
***73 Magazine* Staff**

I made hesitation controls for Ford, Chrysler, and Toyota automobiles. After I sent you my article ("The Hesitator: A Windshield Wiper Control," January, 1982, *73*, page 40), I made one for a friend who owns a General Motors car and ran into a little difficulty. General Motors has a different wiring philosophy for windshield wipers which makes a simpler wiring job to get into it. Instead of the hesitation control unit momentarily connecting 12 volts to the wiper motor as explained in my article, the GM cars momentarily connect the motor to ground to start a park cycle; see Fig. 2.

The wiring at the motor has a three-pin connector. Determine which pin has 12 V when the ignition switch is on. The pin next to it with two leads is the pin needed for the parking cycle start.

The relay contacts in the hesitation control will have to be wired differently; see Fig. 3.

Henry Edwell N4UH
Cleveland NC

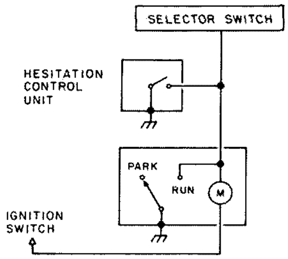


Fig. 2.

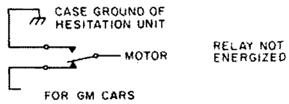


Fig. 3.

HAM HELP

I am looking for information about a R-19 military 100-156-MHz receiver (similar to R-28 but with a different front end), Sperry Gyrocompass repeater Mark XXIV, model 0, Central Electrics model MM-1 multiphase rf analyzer, and model 10 (A or B) single-sideband exciter, military test receiver, type CPR-60 AAB, Bendix Aircraft radio model DA, Millivac Instruments type MV-17C vacuum tube, volt-ohm-milliammeter, and a Servonics Instruments electronic digital voltmeter, model EDR-C. I can make photocopies or will pay a reasonable amount for them.

John White WB6BLV
P1-12 33284
560 N. Indiana St.
Porterville CA 93257

I am in need of a schematic and instruction manual for a Drake R-4B. I will copy and return or pay for a photocopy.

William Bohnenberger
18 E 199 St.
Bronx NY 10468

Does anyone have information on an AM-6154/GRT-21 VHF-UHF amplifier that uses an 8930 in a tuned cavity?

Kent Britain WA5VJB
5809 Stageline
Arlington TX 76017

I need someone to repair my VHF Engineering 2-meter synthesizer. I got it quite a while ago new and factory-wired. VHF Engineering is no longer in business. I've tried several places. The Syn II has never worked with my VHF Engineering 2-meter transceiver, which is OK. I may only be making the wrong connections between the two.

I would appreciate hearing from someone who has used the two together.

Tony W. Stalnaker WA4LPJ
2358 Old Al. Rd.
Thomaston GA 30286

I am looking for an instruction manual and schematic for a Navy Model BL-2 transceiver (rec. type CFN-46ABE, trans. type CFN-52ABE) made by Farnsworth Radio and TV Corp. I also need a manual and schematic for a Jackson Model CRO-2 oscilloscope.

Marion Bell KA9BYN
709 West Broadway
Logansport IN 46947

I need any information on the Heathkit SB110A 6m transceiver and/or Heathkit SB500 2m transceiver. Thank you.

Howard Gorden W3CQH
c/o KSI
Suite #2
8403 Dixon Ave.
Silver Spring MD 20910

I am in need of a schematic and manual for an All Star, Jr., all-wave superhet receiver. It is from the early 1930s and uses plug-in coils.

R. F. Bricker K4CSV
PO Box 295
Fort White FL 32038

I am looking for schematics and manuals for a Mercury FC-2 tube tester, Gonset Communicator (FAA version), and a Panoramic Radio Panadaptor model PCA-2T-200.

R. E. Strathkoetter, Sr. WB6SNN
5453 Traymore
Covina CA 91722

I am in need of a schematic for a model BC-1031-C Panoramic adaptor. I would appreciate any information on adapting the BC-1031-C for use with an HW-101.

Gordon Fulp W6FBH
Rt. 3, Box 572A
Placerville CA 95667

I am need of a schematic and tune-up chart for a Hallicrafters SX122.

George Hennessy WB6KJQ
4273½ Fulton Ave.
Sherman Oaks CA 91403

I am trying to get in touch with an old friend. His name is Mike Nicoli WB2XNY/6. I last saw him in El Toro CA where he was attending UC at Irvine. If you have contacted him or know his mailing address, please contact me.

Dennis Duckworth
PO Box 11025
Stanford CA 94305

I am in need of a schematic or any information on a Model 30 printer made by Litton Industries.

Elmer Eddington
1337 West 41st Place
Los Angeles CA 90037

I am in need of a manual or schematic for a Dumont oscilloscope, model 401-A. I will pay for a copy and all associated costs.

Bernard Krull WD2AEU
230 Brinckerhoff Court
Englewood NJ 07631

I would like information that anyone may have on FMing the Heath Seneca.

Larry Campagnano K1PFD
PO Box 171
Guilford CT 06437

I am in need of a three-digit up-down counter circuit that features programmable inputs, reset, a display driver, and digit multiplexer. I am counting pulses from an optical switch used for computer punch-card readers. This is an experimental project so I would like to keep the cost under $5.00.

Larry Starkweather
8231 Camino Del Oro # 3
La Jolla CA 92037

I would like to join a DX association or foundation. Can anyone supply me with addresses and membership information?

Karl M. Leite PS7KM
PO Box 385
59000 Natal
RN, Brasil

OSCAR ORBITS

SYNCART

Quietly, in California and Canada, a group of dedicated amateurs is making steady progress on a plan to place an amateur radio transponder into a geosynchronous orbit above North America. The project is called SYNCART (SYNChronous Amateur Radio Transponder) and it is a collaboration among AMSAT, Project OSCAR, and AMSAT Canada. If all goes well, the transponder could be in orbit as early as 1984.

An object in geosynchronous orbit appears to hang motionless at a point about 23,000 miles above the Earth's equator. Thus, amateurs who use the communications facilities aboard SYNCART could point their antennas toward the proper point in the sky and leave them there. Since SYNCART will not move relative to the surface of the Earth, no complex tracking mechanism will be required. The main disadvantage of a geosynchronous transponder, from the operational point of view, is that it can provide communications to only about one third of the Earth. At least two more such transponders, placed in the correct locations, would be required to provide global coverage. Nevertheless, SYNCART will provide 24-hour-a-day service to most of Region 2.

As with previous amateur space efforts, SYNCART depends upon the scheduled launch of a "professional" satellite for its transportation into orbit. However, unlike other missions in which the amateur payload always separated from the main satellite to assume its own independent orbit, the SYNCART package will remain attached to the main satellite throughout its lifetime. This is a big advantage for the SYNCART planners, since the transponder need not carry its own stabilization and attitude control systems. SYNCART will rely on the main satellite for these crucial necessities.

At present, plans call for SYNCART to carry a 1269-to-435-MHz transponder. A 245-to-435-MHz transponder is also a possibility. There is also an opportunity for linking to the Phase III satellites, since the 435-MHz downlink of SYNCART can be made to fall within the uplink passband of the Phase III birds. Prototype transponders are presently under construction.

It's well to remember that SYNCART is at least two, and more likely three, years away. No flight hardware has yet been built. Still, SYNCART is an exciting prospect and represents another major step forward in amateur space communications.

RS NEWS

Refinements have become available for the robot frequencies given in last month's article about the Soviet Union's RS satellites (*73 Magazine*, March, 1982, page 121). Table 1 contains the latest information.

The Federation of Radiosport of the USSR has set aside Wednesdays (UTC) for experiments on the RS satellites. All amateurs are asked to refrain from transmitting through the satellites on Wednesdays.

RS information is courtesy of the *AMSAT Satellite Report*. For more information on the amateur space program, write to AMSAT, PO Box 27, Washington DC 20044.

BEACON AND ROBOT FREQUENCIES (MHz)

Satellite Name	Beacon Frequency	Robot Uplink	Robot Downlink
RS-3	29.320	–	–
RS-4	29.360	–	–
RS-5	29.450	145.826	29.331
RS-6	29.450	–	–
RS-7	29.500	145.835	29.341
RS-8	29.500	–	–

Table 1.

OSCAR 8 Orbital Information for April

Orbit #	Date	Time (UTC)	Eq. Crossing (Degrees West)
20752	1	0143:02	95.4
20765	2	0004:23	70.8
20779	3	0008:54	72.0
20793	4	0013:25	73.1
20807	5	0017:56	74.3
20821	6	0022:27	75.4
20835	7	0026:58	76.6
20849	8	0031:29	77.8
20863	9	0036:00	78.9
20877	10	0040:31	80.1
20891	11	0045:02	81.2
20905	12	0049:33	82.4
20919	13	0054:04	83.6
20933	14	0058:35	84.7
20947	15	0103:06	85.9
20961	16	0107:37	87.0
20975	17	0112:08	88.2
20989	18	0116:39	89.4
21003	19	0121:10	90.5
21017	20	0125:41	91.7
21031	21	0130:12	92.8
21045	22	0134:44	94.0
21059	23	0139:15	95.2
21072	24	0000:35	70.5
21086	25	0005:06	71.7
21100	26	0009:37	72.8
21114	27	0014:08	74.0
21128	28	0018:39	75.2
21142	29	0023:10	76.3
21156	30	0027:41	77.5

OSCAR 9 Orbital Information for April

Orbit #	Date	Time (UTC)	Eq. Crossing (Degrees West)
2668	1	0005:31	125.0
2684	2	0127:54	145.3
2699	3	0115:07	141.9
2714	4	0102:19	138.5
2729	5	0049:30	135.0
2744	6	0036:40	131.6
2759	7	0023:40	128.1
2774	8	0010:55	124.7
2790	9	0133:09	145.0
2805	10	0120:13	141.5
2820	11	0107:17	138.0
2835	12	0054:18	134.5
2850	13	0041:19	131.0
2865	14	0028:19	127.5
2880	15	0015:17	123.9
2895	16	0002:14	120.4
2911	17	0124:17	140.7
2926	18	0111:11	137.1
2941	19	0058:04	133.6
2956	20	0044:56	130.0
2971	21	0031:47	126.4
2986	22	0018:36	122.9
3001	23	0005:24	119.3
3017	24	0127:10	139.4
3032	25	0114:04	135.8
3047	26	0100:48	132.2
3062	27	0047:31	128.6
3077	28	0034:13	125.0
3092	29	0020:53	121.4
3107	30	0007:32	117.7

OSCAR 8 Orbital Information for May

Orbit #	Date	Time (UTC)	Eq. Crossing (Degrees West)
21170	1	0032:12	78.6
21184	2	0036:43	79.8
21198	3	0041:14	81.0
21212	4	0045:45	82.1
21226	5	0050:16	83.3
21240	6	0054:47	84.4
21254	7	0059:18	85.6
21268	8	0103:50	86.8
21282	9	0108:21	87.9
21296	10	0112:52	89.1
21310	11	0117:23	90.2
21324	12	0121:54	91.4
21338	13	0126:25	92.6
21352	14	0130:56	93.7
21366	15	0135:27	94.9
21380	16	0139:58	96.0
21393	17	0001:18	71.4
21407	18	0005:49	72.6
21421	19	0010:20	73.7
21435	20	0014:51	74.9
21449	21	0019:22	76.0
21463	22	0023:53	77.2
21477	23	0028:24	78.4
21491	24	0032:55	79.5
21505	25	0037:27	80.7
21519	26	0041:58	81.8
21533	27	0046:29	83.0
21547	28	0051:00	84.2
21561	29	0055:31	85.3
21575	30	0100:02	86.5
21589	31	0104:33	87.6

OSCAR 9 Orbital Information for May

Orbit #	Date	Time (UTC)	Eq. Crossing (Degrees West)
3123	1	0129:17	137.9
3138	2	0115:54	134.2
3153	3	0102:29	130.5
3168	4	0049:03	126.9
3183	5	0035:36	123.2
3198	6	0022:08	119.5
3213	7	0008:38	115.8
3229	8	0130:13	135.9
3244	9	0116:41	132.2
3259	10	0103:07	128.5
3274	11	0049:33	124.8
3289	12	0035:57	121.0
3304	13	0022:20	117.3
3319	14	0008:41	113.5
3335	15	0130:07	133.5
3350	16	0116:26	129.8
3365	17	0102:44	126.0
3380	18	0049:00	122.2
3395	19	0035:15	118.5
3410	20	0021:29	114.7
3425	21	0007:42	110.9
3441	22	0128:58	130.8
3456	23	0115:08	127.0
3471	24	0101:17	123.2
3486	25	0047:25	119.4
3501	26	0033:31	115.5
3516	27	0019:36	111.7
3531	28	0005:40	107.8
3547	29	0126:47	127.7
3562	30	0112:46	123.8
3577	31	0058:48	120.0

HAM HELP

I need to know the name of the amateur magazine, with year and month of issue, that had an article describing a means for sorting file cards. There could be one card per article with the appropriate holes punched in the bottom to allow sorting. The author suggested that a commercial version may be available. Any information regarding the article or a source for this kind of file would be appreciated.

Lester R. Lauritzen
Box 117, RFD Route 2
Centerville SD

I am looking for information on the Bendix RTH 27A two-channel FM transceivers used for communication with jet aircraft on the ground. I don't have the command helmets that went with my units. Any information for converting these units to six meters would be welcomed.

Richard Gillespie KC8BQ
107 Ohio Ave.
Charlestown WV 25302

I need a schematic of and service information for a Hy-Gain Model 628G four-channel scanner. I will pay postage and copying costs.

Ray Dunham
477 East 3rd Ave.
Chico CA 95926

I am in need of a schematic and operating manuals for an Eico Model 315 signal generator, TDA-2 telegraph distortion analyzer, and 2M-3/U capacitance analyzer. I will pay copying costs and postage.

H. Hutchison KA0HYH
PSC Box 953
APO MI 34001

I am in need of a Kenwood TR-999 transmitter.

Wayne Hale WA6LCW
839 Mendocino Ave.
Berkeley CA 94707
(415)-525-5702

PROPAGATION

J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	7A	14	14	14
ARGENTINA	14A	14	14	14	7B	7A	14A	21	21A	21A	21A	21A
AUSTRALIA	21A	14	14	7B	7B	7B	14B	14	14	21	21A	21A
CANAL ZONE	14A	14	14	14	7	7	14	21	21A	21A	21A	21A
ENGLAND	7	7	7	7	7	7A	14	14	21A	21A	21	14
HAWAII	21A	14	7A	7	7	7	7	7	14	21	21	21A
INDIA	14	7A	7B	7B	7B	7B	14	14A	14A	14	14	14
JAPAN	21A	14	14B	7B	7B	7B	7	7	7	14B	14	21
MEXICO	21	14	14	7	7	7	14	14	21	21A	21A	21A
PHILIPPINES	14A	14	7B	7B	7B	7B	7B	7B	14B	14	14	21A
PUERTO RICO	14	14	7	7	7	7	14	14	21A	21A	21	21
SOUTH AFRICA	14A	14	7	7A	14	14	21A	21A	21A	21A	21A	21A
U.S.S.R.	7	7	7	7	7	7B	14	14	21A	21A	14	7
WEST COAST	21A	21	14	7	7	7	7A	14	21	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	14	7A	7	7	7	7	7	7A	14	14	14A
ARGENTINA	21A	14A	14	14	7A	7A	14	14A	21A	21A	21A	21A
AUSTRALIA	21A	14	14	14	7B	7B	14B	14	14	21A	21A	21A
CANAL ZONE	14A	14	14	14	7A	7	14	21	21A	21A	21A	21A
ENGLAND	7	7	7	7	7	7	7B	14	21	21A	21	14
HAWAII	21A	21	14	14	7	7	7	7	14	21	21A	21A
INDIA	14	14	7B	7B	7B	7B	7B	14	14	14	14	14
JAPAN	21A	21	14	7B	7B	7B	7	7	7	14	14	21
MEXICO	21	14A	14	7	7	7	7A	14	14A	21	21A	21A
PHILIPPINES	21	14	7A	7B	7B	7B	7B	7B	14B	14	14	21A
PUERTO RICO	21	14	14	7	7	7	14	14	21	21A	21A	21
SOUTH AFRICA	14A	14	7	7B	7B	14B	14	21	21A	21A	21A	21A
U.S.S.R.	7B	7	7	7	7	7B	7B	14	14A	14A	14	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	14	14	7A	7	7	7	7	7A	14	14	14A
ARGENTINA	21A	21A	14A	14	7A	7A	14	14A	21A	21A	21A	21A
AUSTRALIA	21A	21A	14A	14	14	14	7B	14	14	21A	21A	21A
CANAL ZONE	21A	21	14	14	7A	7A	14	21	21A	21A	21A	21A
ENGLAND	7B	7B	7	7	7	7	7B	14B	14	21	14A	14
HAWAII	21A	21A	14A	14	14	14	7A	7	14	21A	21A	21A
INDIA	14A	14	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	21A	21A	21	14	7B	7B	7	7	7	14	14	21
MEXICO	21A	21	14	7	7	7	7	14	21	21	21A	21A
PHILIPPINES	21A	21	14A	14	14B	7B	7B	7	14B	14	14	21A
PUERTO RICO	21A	14A	14	7A	7	7	7A	14	21	21A	21A	21A
SOUTH AFRICA	14A	14	7	7B	7B	7B	14B	14	14A	21A	21A	21A
U.S.S.R.	7B	7B	7	7	7	7B	7B	14B	14	14	14	7B
EAST COAST	21A	21	14	7	7	7	7A	14	21	21A	21A	21A

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair G = Good
P = Poor * = Chance of solar flares; # = of aurora

APRIL

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G/F	2 G/G	3 G/G
4 G/G	5 G/G	6 G/F	7 G/G	8 G/G	9 G/F	10 G/F
11 F/F	12 F/F	13 G/G	14 G/G	15 G/G	16 F/F*	17 G/G
18 G/G	19 G/G	20 G/G	21 F/F	22 F/P	23 F/F	24 G/G
25 G/G	26 F/F*	27 F/F*	28 F/F*	29 F/P*	30 F/F	

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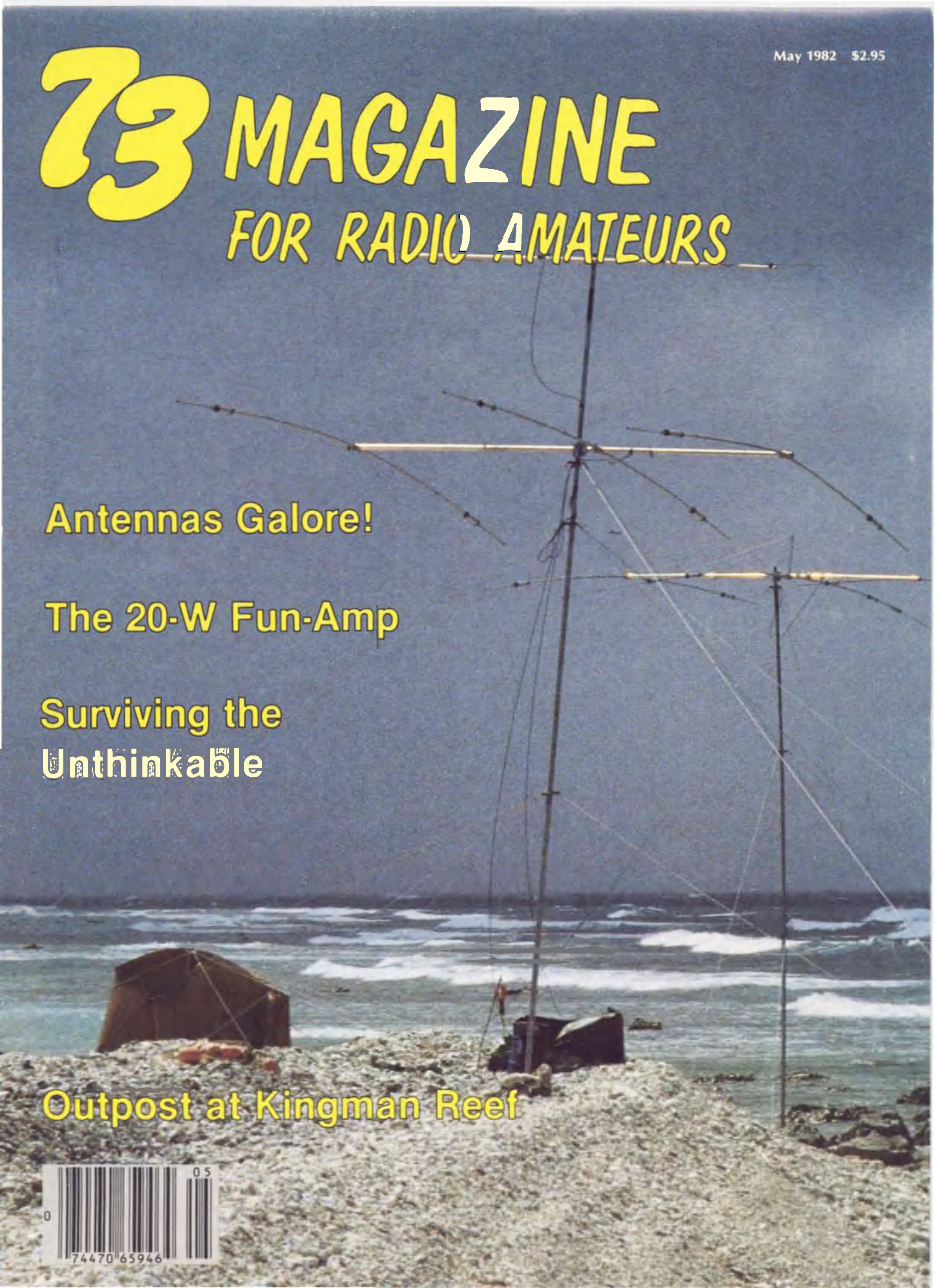
73 MAGAZINE
FOR RADIO AMATEURS



Antennas Galore!

The 20-W Fun-Amp

Surviving the Unthinkable

Outpost at Kingman Reef

0 74470 65946 05

may 82

73 MAGAZINE

Vol. XXII No. 8

Cover: Photo by J. D. Binder KB7NW.

solidified; *Banyandah* was to sail to Hawaii early in 1981, outfit herself with complete base-camp equipment, and be ready for the first group of operators by spring. Unfortunately, Harry's time to organize such a massive undertaking diminished as his electronic repair business in Sydney grew, and by late 1980 it became obvious that he would not be able to help on the first leg of this epic adventure.

At that time, the thirty-eight foot *Banyandah* was in the mid-north Pacific, battling heavy seas and gale-force winds on an early-winter crossing from Japan to Hawaii. It appeared that K/P would be an all-American operation, so I turned to my good friend, Karl Jensen KJ7B, in Seattle for help. With his usual efficiency, Karl put the word out through all the DX clubs and bulletins while spreading it across the airwaves. The initial response for the three operators needed was terrific; within a week he had a two-page list of potential candidates. But these glad tidings were short-lived; after the full requirements were explained to each candidate, all but two dropped out. To some, the three-thousand-dollar financial commitment was too steep (although as full-scale DXpeditions go, it was cheap). But to all, the real problem lay in the enormous time required to complete the two operations and make the 2,300-mile voyage. Not many people can afford thirty-five to forty days away from family or employer.

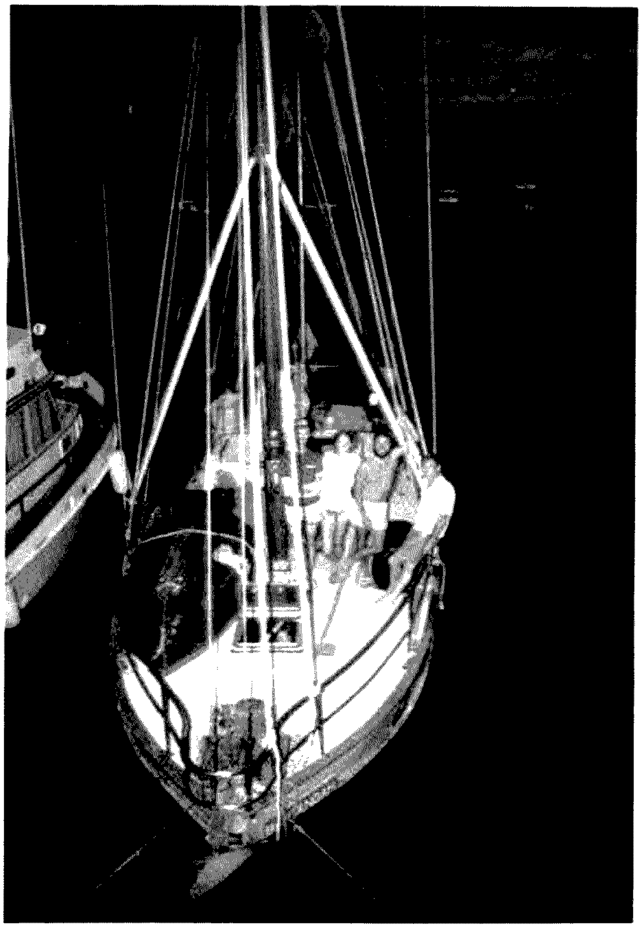
Upon our arrival in Honolulu in early December, we still had only two operators willing to challenge K/P. One, the eventual DX King of Kingman, was a quiet, family man from Minnesota. George Carleton ADØS had a burning desire to try his hand at big-time DXing. In our chats, enthusiasm seemed to ooze from his every rf wave. He was a social worker at one of the state hospitals back in Bremer, Minnesota. A plodder, a converted CB operator, he took to the challenge of DXing like a big gun from W6-land. George and his friends outgrew the local radio club when they met resistance for more DX activities. They formed their own club, the Paul Bunyan Wireless Association, immediately entered every club contest around, and offered night courses for future hams.

George and I were so diametrically opposite in backgrounds that we immediately formed a fast friendship. While I've always been a globe-traveling gypsy, working and living in almost every part of the world, George had never left his native mid-America. He married his childhood sweetheart, stuck with his original employment, and carved a homestead out of thirty acres of rural forested land.

The other operator, the third corner of the triangle, was a fine and proven contest operator from California. Kingman was his dream and an allband operation his goal. More about him later.

As the New Year rolled in, *Banyandah* lay under the highrises at Waikiki and we still had four months of preparations before us. A daily planning session was set up on 15m, with Karl KJ7B acting as the group's central coordinator. Tasks were assigned, with one operator to solicit equipment from manufacturers, the other to solicit financial aid and sponsors. My wife, Judith, and I started the laborious chore of purchasing the numerous supplies and modifying our ship to hold them.

For the base camp, we purchased two large Coleman tents, three folding tables and chairs, a propane cooker, pots and pans, dishes, water containers, sleeping bags and air mattresses, flashlights and internal lighting, all with spares and backups. In other words, our list included everything necessary to exist on a bare pile of shells in the middle of the ocean. On the critical power plant side, we chose the best: two Onan 2.5-kW portable gasoline generators modified especially with automatic oil feeders. They were expensive, but they came with built-in fuel pump, oil pressure pump, and a robust cast-iron engine. A selection of spares also was taken so that any breakdown could be remedied, including a broken crank rod. Hundreds of other items also were loaded aboard for the base camp: large-capacity plastic fuel drums, funnels, fuel transfer pumps, separate power leads for each station, and home-made twenty-seven foot push-up towers with four-foot long stainless steel anchoring stakes.



From left to right: George ADØS, Judith Binder, the author, and Bill W6HTH, aboard the S.Y. Banyandah *before departing for Kingman.*

And let's not forget the food. Case after case came aboard as Judith returned from her forays into Honolulu's markets. Can you imagine the quantity and variety necessary to feed five adults plus our two children for five weeks without a supermarket in sight for a thousand miles?

On the electronics side, matters were not progressing as smoothly. Manufacturers' budgets were getting tighter and tighter. In the past, outright donations

strange forces. For thousands of miles they will remain constant, flowing in one direction at a reliable rate, but upon an approach to land, with the sea bottom suddenly rising, they become unpredictable. To make matters worse, somewhere in this area we would leave one current and enter the world's strangest current, the equatorial countercurrent. This narrow band of water defies all sense by moving directly opposite to the normal trade winds. Its northern limit shifts back and forth across the region at a whim of some unseen force, causing distress among all ship captains who sail this area. Normally, a very wide berth would be given to Kingman, but it was my job to find it safely.

Soon the wind freshened and swung ominously to the southeast. Rain began to fall. It increased until my vision was down to a scant fifty feet. But *Banyandah* heedlessly sailed on, blindly cutting through the water while closing the distance between us and one of this ocean's worst navigational hazards. As the miles ticked off, I held my breath and prayed that my instruments and sights were correct and that our luck would hold. Every few minutes I poked my head above the spray dodger and peered into the rain and gloom, expecting to see that flash of white signalling breakers and destruction.

By 0400 hours, I had had enough and dropped the headsail and mizzen. Quietly, the ship came into the wind, gently rocking in the swell. I woke Judith and crawled into the bunk. "Wake me if the stars show," I said, and immediately fell asleep.

Just before 0600, I was up again. The storm had passed and the first tinges of pink lit the eastern horizon. Quickly Judith and I measured the angle between horizon and our favorite navigational stars, jotting down the exact time of each sight. My voice calling out "Mark!" at each sight must have woken George and Bill; sleep was still in their eyes when they crawled out of the stern cabin. George scanned the blank horizon and said with a grin, "No trees in sight yet." And we all laughed since this was the Minnesotan's usual way of greeting a new day at sea.

George ADØS, making one of the 12,176 KH5/K QSOs.

The star sights didn't take long to work out and showed that we were still thirty miles from that danger which had seemed so near in the rain and the dark. The current had worked its magic and had pushed us away instead of closer. The wind had gone with the passing rain, leaving a calm sea and a bright hot day. Now under power, we continued on a new heading. A scum line was passed—a convergence of currents trapping bits of floating plastic and discarded light bulbs, all alive with small crabs and tiny fish. All morning I tracked the sun with my sextant, and my chart became a mess of intersecting position lines, each a bit closer. By the time the sun reached its azimuth we were very close, and conditions were perfect for a landing.

At 1300 hours I climbed our forty-five-foot mast and scanned the horizon. The sea was flat and calm, the horizon sharp but empty. At 1400, with (supposedly) only six miles to go, I climbed again. There! Just near the edge of the world a vague splash of white showed for a moment and I couldn't believe my luck. The breakers of Kingman Reef were in sight! At deck level, the rest of the crew jumped up and ran to the rail, but nothing could be seen. For the next hour they strained for their first glimpse. Finally, with only two miles to go, George let out a whoop of delight. The rest happened fast. One moment a flat sea, the next a long line of small breakers off our beam and the sea changed from deep blue to aquamarine. Coral heads seemed to rush up to meet us. As we crossed the sunken reef, they were plainly visible even though the depth meter recorded seventy-five feet.

Portable KH5/K first appeared as a heap of brilliant yellow-white sand, sterile and completely devoid of vegetation. The ridge of fine coral rubble and upturned coral boulders was the result of thousands, maybe millions, of years of the sea crashing against the outer barrier reef and washing the broken bits of coral and dead shells into a pile. Excitement ran high as we toured the area in the lee of the cay, taking soundings for anchoring.

It was then that we met the first evidence of Kingman's wildness. Although the depth recorder showed a steady bottom, it was over two hundred feet down! And it was all the same, right up to the perpendicular cliff of reef. At a quarter mile off, I said a silent prayer and lowered the anchor down into the blue, paying out every inch of warp, shaking my head as it slithered over the bow rollers and disappeared from sight.

The cay seemed to grow smaller instead of bigger as we approached in our ten-foot aluminum dingy. Soon it could be seen that its side was steep and not the long gentle slope we had first seen. Kingman was not smooth sand but an im-

stores) appears to provide a good, inexpensive solution.

Ground

A quarter-wave antenna requires a low-resistance ground to be an efficient radiator. The station equipment must be properly grounded to keep rf off the equipment chassis and to prevent rf feedback. The grounding arrangement that met these requirements is shown in Fig. 2. The heavy straps shown are all 3/8" braid.

It is common practice to increase radiating efficiency (reduce ground losses) of electrically short antennas by laying quarter-wave conductors out in all directions from the base of the antenna either on or below the ground—the more radials the better. Since in this installation the base of the endfed inverted-L is terminated at the house and because of the narrow width of the lot, even a small number of radials cannot be accommodated. I settled for one 135-foot radial connected to the common ground point inside the window, dropping directly from the window to the ground below and running approximately under and approximately parallel to the horizontal portion of the antenna. The single radial is buried a few inches under the ground to get it out of harm's way.

It did not take long to determine that this antenna and ground combination was a good radiator. However, it left much to be desired as a receiving antenna. Consistently, I was being copied by stations that I could not pull out of the noise. Consistently, the other stations were copying stations that I could not copy. My station was "receiving limited."

Receiving Antenna and Preamplifier

In searching for a better

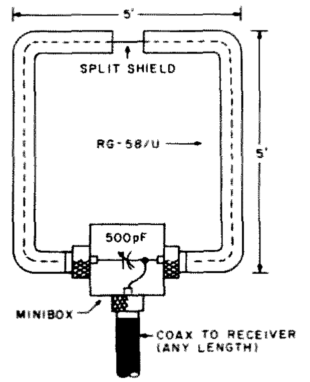


Fig. 3. Loop receiving antenna.

receiving antenna, I came across the 5-foot, single-turn, shielded loop in *The ARRL Antenna Handbook* (see Fig. 3). Much to my surprise and delight, this little loop mounted two feet above the ground and working into a preamplifier proved to be a simple, convenient antenna with superior performance. The loop was made of RG-58/U coax mounted on a 6½-foot wooden dowel mast with light wood cross pieces. The mast was mounted on a TV antenna rotor which was in turn mounted on a 2-foot-square plywood base. RG-58/U was also used for the feedline. With the recent reopening of 160, it would be better to construct the loop and feed using lower-capacitance RG-59/U foam cable. This would provide increased performance across the band.

The signal level produced by the loop antenna is quite low but easily can be boosted to an acceptable level with a simple transistor preamplifier. Because the preamp I used was home-built and because there are some associated system ramifications, a description of the circuit is included here (Fig. 4).

This simple preamp was not designed, but rather built from the simplest FET circuit I could find out of

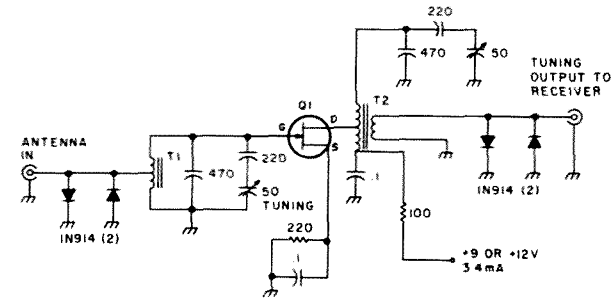


Fig. 4. 160-meter preamplifier. Q1—FET, Radio Shack 276-2036; T1—Amidon T50-2 toroid core, approximately 50 turns (core full), tapped at 6 turns; T2 is the same as T1 except that it is tapped at the center and has a 6-turn link over the ground end.

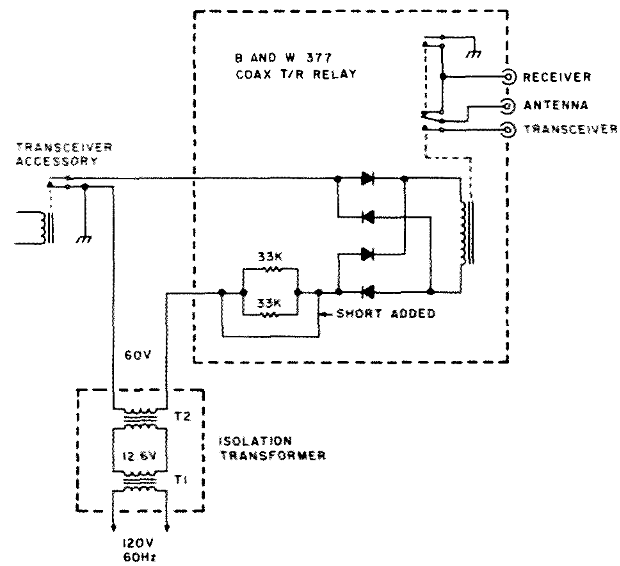


Fig. 5. T-R relay details. T1—Radio Shack 273-1505, 120:12.6 V, 1.2 A; T2—Radio Shack 273-1386, 120:25.2 V, 0.3 A.

available parts. The input and output tuned circuits were arranged to cover 1800 to 1850 kHz. It could undoubtedly be improved, possibly by broad-banding, to eliminate the need for tuning. It provides a gain approaching 20 dB, but in my "brassboard" model is uncomfortably close to oscillation. It performed well enough on the first try that no effort was put into improving it. It would have to be modified to cover more than the 1800-to-1850-kHz portion of the band.

Since this article was first written, the 160-meter band has been opened to 1900 kHz and the loop performance has been improved by replacing the preamp in Fig. 4 with an untuned broadband preamp at the base of and connected directly to the loop.

Note the protective diodes in both the input and output of the preamp. The input is wide open on transmit and there is a danger of transmitting into the output, hence the diode protection on both ends. With 100 Watts into the inverted-L and with the loop antenna about 10 feet from the downlead, a peak audio-frequency signal of 6 volts is developed across the

more heat, which causes more current. Eventually, the transistor can self-destruct. VMOS FETS have just the opposite effect—more heat tends to decrease current flow.

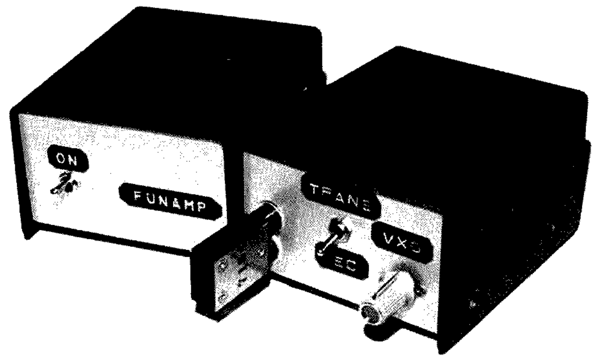
Mismatch burnout occurs in regular transistors when an impedance mismatch occurs between the load (antenna) and the output network. This is seen when a high swr exists—such as with an open line or non-resonant antenna. This condition can destroy most transistors quickly, but the VMOS FET comes through with flying colors.

Additional benefits of the VMOS FET are the ease of parallel use and ease of matching input and output. In order to reach the 20-Watt output level with Radio Shack parts, it was necessary to parallel three VN67AF VMOS FETs. No current hogging exists with VMOS, so no "ballasting" resistors were needed.

One problem of the VN67AF VMOS is the built-in static protection zener diode. This diode limits the maximum gate-to-source voltage which in turn limits the output power. Unfortunately, Radio Shack sells only the VN67AF. VMOS devices are manufactured without the zener diode, but in order to meet the objective of Radio Shack part usage, they were not used.

Fig. 1 shows the simple schematic of the Fun-Amp. I decided to use as simple a design as possible and thus eliminated an input network and an intricate output transformer. A good design goal for home-built equipment is "make it as simple as possible." The amplifier, however, does not suffer in performance due to the simplicity.

The input from the Fun-Mitter is applied to a "pi-type" attenuator (R1, R2, R3). This reduces the input power to the VMOS FETs to the needed level. The Fun-Amp can be driven with only 2 Watts, if desired, to reach the 20-Watt output level. This will be described in detail later. Three VN67AF VMOS FETs are used in parallel to generate the 20 Watts of rf power. Each FET supplies about 1/3 of the total power.



Because of the VMOS's built-in zener diode, CR1 has been added to the circuit. It clips the input sine-wave signal so that it does not go negative. If CR1 was not in the circuit, the FET would quickly be destroyed.

There is no forward bias used on the FETs and thus the amplifier operates in Class C. This is significant for two reasons. One, the amplifier can be used only for CW operation. SSB operation will result in severe distortion. Secondly, Class C operation results in high efficiency (power in/power out), which is a definite plus.

The output network consists of L2, L3, and C3. This network is commonly referred to as a T-network and its function is to match the output impedance of Q1-Q3(16Ω) to the 50Ω antenna load. It also offers some harmonic attenuation. L2 and L3 are constructed from Radio Shack 10-μH rf chokes—a technique familiar to builders of the earlier gear.

The amplifier is operated from +24 V, same as the Fun-Mitter. Current needed for the amplifier is around one Amp. The power supply described in the Fun-Mitter article should work fine, provided the regulator is mounted on a good heat sink, such as part number 276-1361. Total demand from the supply if both the Fun-Mitter and Fun-Amp

Parts List

C1	570 pF (470 and 100 in parallel)	272-125
		272-123
C2,C5	0.1 uF	272-135
C3	80m: 1000 pF	272-126
	40m: 470 pF	272-125
C4	.01 uF	272-131
C6	10 uF, 35 V dc	272-1013
CR1	1N914 small signal silicon	276-1122
CR2	1-Amp, 50-V diode	276-1101
J1,J2	SO-239	278-201
J3,J4	Phono jack	274-346
K1	DPDT relay	275-206
L1	10-uH rf choke	273-101
L2	Modified 10-uH rf choke	273-101
	For 80 meters remove 14 turns	
	For 40 meters remove 19 turns	
L3	Modified 10-uH rf choke	
	For 80 meters remove 10 turns	
	For 40 meters remove 15 turns	
Q1-Q3	VN67AF VMOS power FET	276-2071
R1,R3	For 5-Watt Fun-Mitter use 150Ω,1/2 W	271-013
R2	For 5-Watt Fun-Mitter Use 33Ω,1/2 W	271-007
R4	47Ω, 1/2 Watt	271-009
R5	47k Ω,1/4 Watt	271-1342
R6	155Ω (three 470Ω, 1/2 W in parallel)	271-019
S1	SPDT switch	275-612
Misc.	TO-220 heat sink (3)	276-1363
	Heat sink grease	276-1372
	Case	270-251
	Hardware	64-3012
		64-3019
	Wire	278-1304

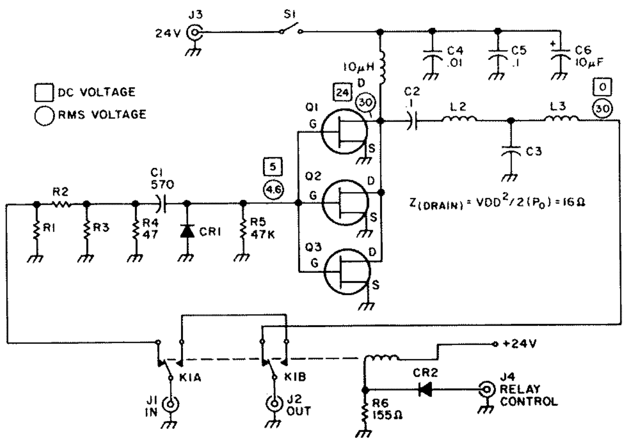


Fig. 1. Schematic.

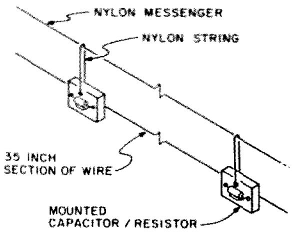


Fig. 3. Nylon messenger and 1 section of antenna.

tenna was suspended. Initially, I hung the messenger 3½ feet above the ground.

Next, I made a jig on a piece of wood which had two nails separated exactly 35 inches. Then I bent 48 pieces of wire around the nails, leaving a 2-inch tail at each end. The tails are used to tie in the resistor/condenser combination. When you've finished cutting and bending the 48 pieces of wire, put them aside in a neat arrangement so they won't snarl.

I used 46 one-Watt resistors, with a value of 47k, and 46 Mallory SXM 339 capacitors, 390 pF, at 160 volts dc. Prior to installing these capacitors, I found that 2 were defective, and 1 was not within tolerance. The testing of the capacitors prior to installation can save you a lot of problems and work later on.

The next job was to make 48 insulators and the feedpoint insulator. I used some 1/8-inch Lucite that I had in the junk box. Figs. 1 and 2 give the details. The next step involved mounting and soldering a capacitor and resistor to each section of wire. Remember, you have 48 sections of wire and only 46 capacitor/resistor combinations. Start at the feedpoint insulator and connect the first section of wire (the end without the insulator) to the feedpoint insulator solder lug and solder it.

The other end of the wire will have the capacitor/resistor mounted on an insulator. Refer to Fig. 1 and note the hole at the top middle of the insulator. I used a 7-inch piece of nylon string and suspended the insulator about 3 inches below the messenger. I continued this process until all the sections were installed and soldered. Using this method of suspending the wire sections allows the antenna to ride free, with no mechanical strain on it whatsoever. So far the antenna has withstood 45-mph winds, rain, and hot sun without any problems. Fig. 3 shows a section of the completed antenna.

The mechanical work is now completed, and we're ready to begin the preliminary antenna tests. I used the authors' design criteria[1] for a 40-meter antenna with a low frequency cutoff of 7050 kHz. I connected a 3-turn loop at the feedpoint insulator and, using a grid-dip meter, resonance occurred at 7002 kHz. Next, the 300-Ohm TV feedline was connected to the feedpoint. About 80 feet of line was needed to reach the shack. I prefer the use of an antenna tuner rather than a 4:1 step-up transformer, because a tuner permits you to tune out any residual reactance in the overall antenna system. Next, I tuned up the transceiver on 7200 kHz and adjusted the antenna tuner for minimum swr between the exciter and the input of the antenna tuner. Using a Bird wattmeter, I set the output of the exciter to 1 Watt. Any swr meter will serve the same purpose; the main consideration here is that only a minimum of power is required to excite the antenna. The rf indicator which I used to check each section of the antenna consisted of a 50 μA meter, using a couple of 1N34s as rectifiers. A 6-inch piece of wire was used as the rf probe. Next, I walked the entire length of the antenna, holding the rf probe at a uniform distance from the antenna, and checked each section. At the ends of each section, I recorded 12 μA, and near the middle of each section, the rf probe indicated 29 μA. These same approximate readings occurred at each section, right down to each end. In other words, I had a uniform radiating surface over the entire length of the antenna. Remember, this antenna is only 3½ feet above ground. It didn't take me long to get back into the shack and fire up on 40 meters.

The first thing that I noticed was that the receiver was very quiet. Signals were right up there in strength. I made three contacts (about 200 miles) and my reports were Q5 and S9 plus. This was with 100 W dc input. I left the antenna at 3½ feet for about a month and did a lot of listening and QSOing. The results have been more than gratifying.

My next task was to raise the antenna to 50 feet. This was a snap with the nylon messenger. All I had to do was coil the antenna up, take it to the mast, stretch it out, attach the feedpoint insulator to the halyard, and pull it up. Next the ends of each messenger were snaked through and among the trees and secured wherever convenient. I find it difficult to describe the physical configuration of the antenna, but the feedpoint is up about 50 feet and the rest of the antenna is hidden among the trees. I have 86 trees on the property and an XYL who loves trees; 'nuff said.

All in all, I'm very happy with the results of this antenna and I'm thankful to W4FD and W4ATE for providing me with a very interesting and rewarding project. ■

References

1. Harry A. Mills, Gene Brizendine, "Antenna Design: Something New," *73 Magazine*, October, 1978.
2. Harry A. Mills, Gene Brizendine, "The CCD Antenna—Another Look," *73 Magazine*, July 1981.

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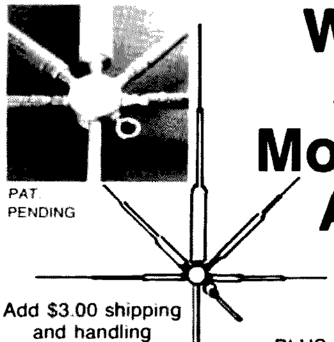

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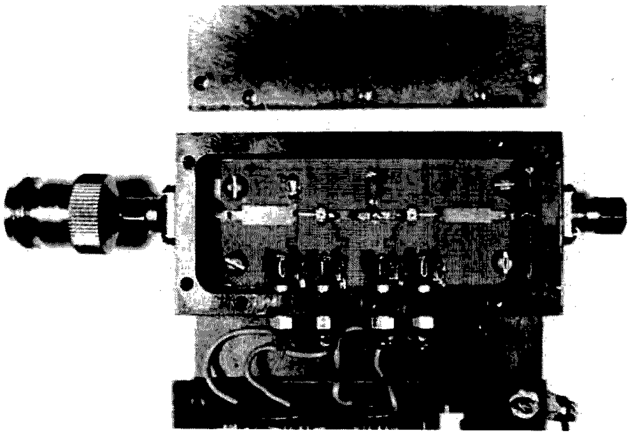
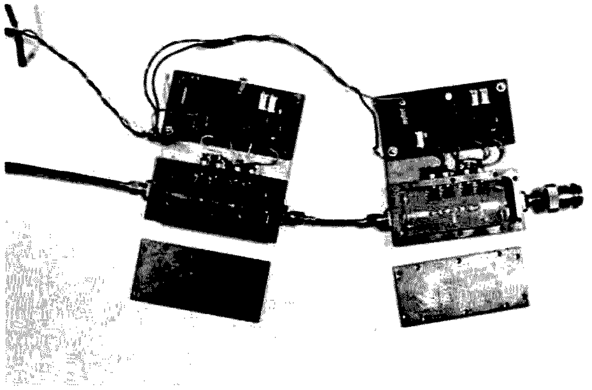


One stage of the low noise amplifier (LNA) described in "Job's Own LNA," 73 Magazine, February, 1982.



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We will describe as we go some of the things we tried that either didn't work or didn't meet our expectations. During our development, we were extremely fortunate to have a professional video technician, Alex Guarino WA4OCG, to critique our received signal video and offer suggestions on improving it. Alex now favorably compares our received video with the commercial cable TV installations with which he is familiar.

We had never seen a satellite TV installation before we got our homebrew system working and, during the development of our system, we did not have access to any test equipment that functions on the satellite TV frequencies. The only test equipment used to debug the system was an old Heathkit Tunnel Dipper (grid-dip meter), a sweep generator, a marker generator, and a 5-MHz Heathkit oscilloscope. So, if we can make a receiver work with our very limited test equipment, we feel that any average technician, using our proven PC board designs, can easily duplicate our system.

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70-MHz Bandpass Filter and I-f Amplifier

Just like your ham band receiver, the signal from the mixer contains many signals and noise. Therefore, the first step after the mixer is to clean up the signal and eliminate all frequencies we don't need. The output of the mixer is a low-level signal of approximately −50 dBm. Refer to Fig. 2, the filter/amplifier schematic. This low-level signal is applied to IC A-1, a Motorola MWA-120 broadband amplifier with 14 dB of gain.

70-MHz Bandpass Filter/I-f Amplifier
Parts List

- 1 2-1/4" × 4" × 2-1/2" minibox, Bud CU-3003A
- 1 PC board, double-sided (Martcomm, Inc., Box 74, Mobile AL 36601)
- 3 MWA-120 ICs
- 1 7815 voltage regulator
- 2 1-uF tantalum capacitors, 35 volts
- 3 470-Ohm, ½-Watt resistors
- 2 2200-Ohm, ¼-Watt resistors
- 1 470-Ohm, ¼-Watt resistor
- 1 51-Ohm or 47-Ohm ¼-Watt resistor
- 2 .01-uF disc ceramic capacitors
- 2 J. W. Miller coils, L1 and L4, 49A678MPC, .60-.074 uH
- 1 J. W. Miller coil, L5, 49A347MPC, .250-.415 uH
- 2 J. W. Miller coils, L2 and L3, 49A537MPC, .393-.657 uH

Total cost is approximately $60.00.

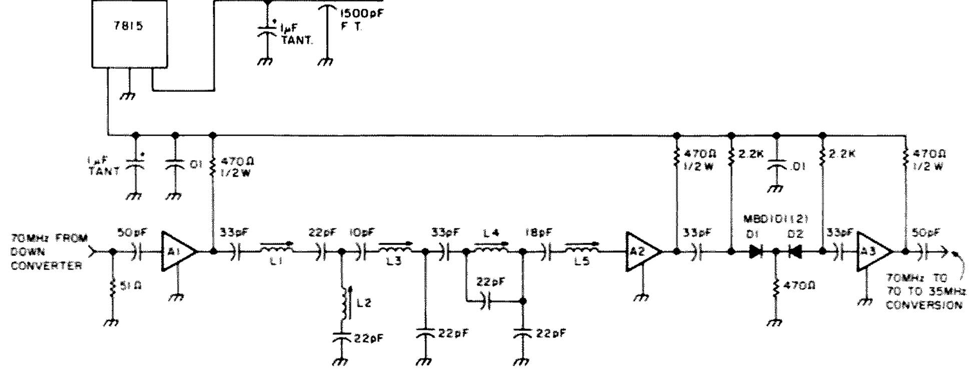


Fig. 2. 70-MHz filter/amplifier schematic.

audio and AFC-1 pickoff points are at the emitter of this transistor. The AFC-2 junction point is on the collector of this transistor. The de-emphasis filter also connects to the 2N2222 emitter, and then goes through an audio trap to the NE592 video amplifier.

The NE592 has complementary outputs, which makes it simple to provide video reversal (not all transponders use the same video polarity). The output of the 592 feeds the base of another 2N2222. The emitter of the second 2N2222 is ac-coupled to the base of a third 2N2222 whose base is clamped with a zener diode and a hot-carrier diode to keep the 30-Hz energy dispersal waveform from appearing at the video output. The 30-Hz component, if not removed, will wreck your vertical sync. The 1-volt video output is ac-coupled and terminated with a 100-Ohm resistor.

Construction

To make construction really simple, a PC board layout and parts overlay is provided. See Fig. 8. The PC board is double-sided G-10. The parts overlay is shown in Fig. 9.

For easiest assembly, install all resistors first and then the capacitors and chokes. Transistors are installed next, being sure that they are properly inserted. Power up the board and check the ouput of the voltage regulators for correct voltage before inserting the ICs. Save the ICs for last. You can use a socket for the NE592, but do not use a socket for the NE564.

Tune-Up

The joy of using the NE564 becomes evident when you get to the alignment procedure. Set the 1k pot and 10k pot at mid-position. Apply power. Adjust the 1k pot for 5 volts dc on pin 10 of the 564. Connect a frequency counter or grid-dip meter to the "VCO out" point on the board and adjust the variable capacitor for a 70-MHz vco frequency. Assuming that you have the rest of your system working, connect the output of the 70-MHz filter i-f amplifier board to the video demodulator board. With a video monitor attached to the video output, you should have satellite TV! Congratulations!

The final adjustment is made while watching video on your TV. Adjust the 10k pot for 1-volt video out or at least good contrast on your monitor. Now is the time to adjust the 1k pot on pin 10 of the 564. Monitor the pin 10 voltage while adjusting the pot. Changing

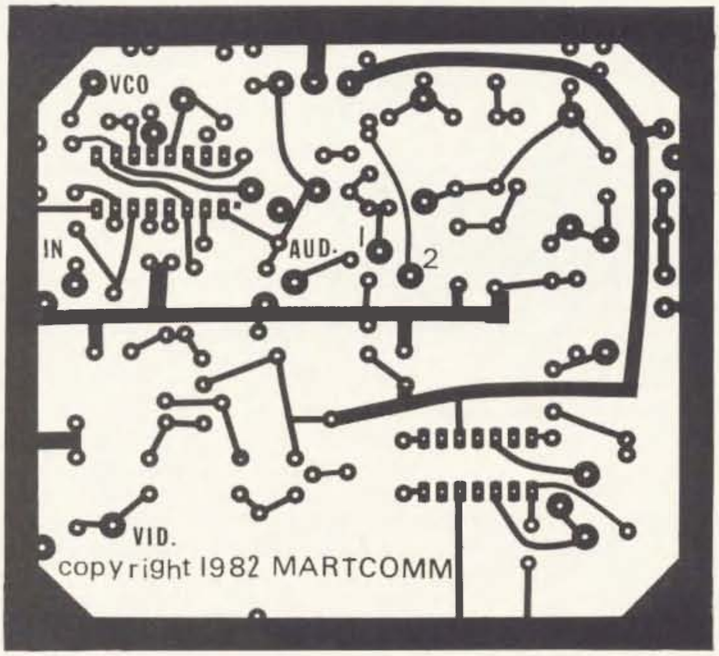


Fig. 8. Video demodulator PC board.

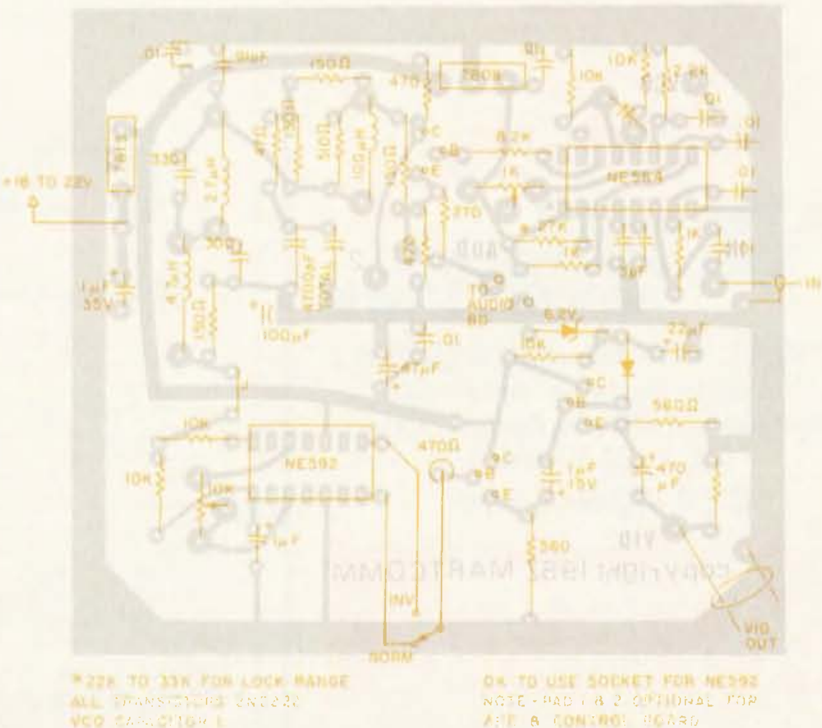


Fig. 9. Component layout for video demodulator board.

of infinite cleverness or wisdom you may enjoy when you recycle useless junk!

The Universal Circuit

Or you can build a fixed-frequency detector. The most popular circuit in use today is one using a single IC. Known by such names as the LM3065, CA3065, or MC1358, this simple chip is nothing more than a quadrature detector which forms the guts for most TV-set sound circuits. See Fig. 3. The subcarrier feeds a bandpass filter tuned to the appropriate frequency which in turn feeds the chip for detection and de-emphasis.

Deep in its heart of darkness, the chip amplifies the signal into limiting before it is detected. In addition, the chip also contains an electronic attenuator and an output driver amp. A variable resistor from pin 6 to ground controls the electronic attenuator. Minimum resistance gives maximum volume. The distortion specs on the amp are not too sweet so it is best ignored. Besides, you can get nearly 0 dBm out of the bare detector, anyway—more than enough to ionize the plastic transistors in any amplifier.

You can build one of these detectors in an evening, but there is a better way. Buy it already built! As I've mentioned before, regular TV sound detectors are just about the same thing, circuitwise, except that they are tuned to 4.5 MHz. They differ from satellite audio ever so slightly in frequency, de-emphasis, and bandwidth. Interestingly enough, the entire sound section for an RCA XL-100 TV contains just such a circuit on the small PC card seen in Fig. 4.

Build It Quick and Dirty

The XL-100 sound modules are available at most TV distributors. They cost about 15 dollars and are a bargain when you consider what your time is worth these days to build one from scratch. Order an RCA part number MAA001A.

The units come tuned to 4.5 MHz for TV sound. Just a few mods will make them tunable from 5 MHz to nearly 8 MHz. Change the value of C290 to 50 pF. Also change C295 to 25 pF. This will shift the unit from 4.5 MHz to about 6.5 MHz. Then solder a .01-μF capacitor from pin 13 on the chip to a ground trace. This sets the de-emphasis to 75 μsec.

Build a well-regulated supply the easy way by using a molded plug-in dc charger/power supply connected to a large-value capacitor and a 3-terminal regulator as seen in Fig. 5. Just be sure to include the capacitor on the output of the regulator or it will quickly lose its cool in the worst way.

Everything should fit into a small 2 × 5 box even if you use a soldering gun rather than a pencil iron. See Fig. 6 for an idea on layout. Use whatever connectors you have in your junk box. Nothing is critical except for the mandatory use of coax from the receiver to the unit. The tap-off in the receiver is simply the same place the other sound detectors connect, usually right after video detection.

Tune-up is easy. Use your ear and twist T299 and L299 until you hear sound. A better way is to feed your signal generator into the unit while looking at pin 9 on the chip with a scope. Once you see rf, back down the generator below limiting (done by the chip) and peak T299 and L299 for the frequency you want. If you can frequency-modulate the generator, by all means do so and set it for ±75-kHz deviation. Then look at the demodulated audio and adjust L299 for the best waveform. A THD analyzer can be used to improve the distortion specs with a variable resistor in parallel with C295 and L299 to lower the Q.

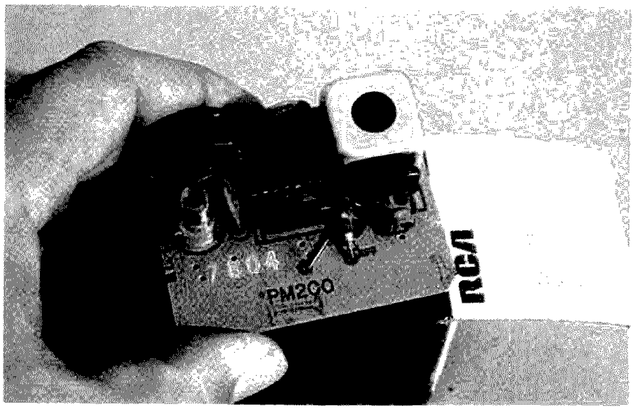


Fig. 4. Known by TV servicemen as the PM200, this small card holds nearly an entire TV-set sound section. It's a natural for cheap satellite audio recovery.

Next, align the bandpass-filter coils simply by peaking. You may not need the coils at all depending on the prefiltering done in the receiver. The ideal coil adjustment method is to first peak everything including L299. Then short the second coil with a 10-Ohm resistor (you'll need more umph from the rf generator) and peak again. Remove the resistor, back down the generator, and re-peak the second coil.

Bells, Whistles, and Distortion

If the subcarrier decoder is intended as a TV sound detector, you'd better leave the 50k volume-control pot in the circuit so that you can adjust audio drive to a subsequent rf remodulator. If you are feeding another amp, you could just as well forget the pot by grounding pin 10 on the board (pin 6 on the chip). This will set the output at maximum, about 0 dBm across 600 Ohms using a 12- to 16-volt supply.

You can save in the amplifier department, too. The amplifier for an RCA XL-100 is also available. Order MAN002A and use the circuit in Fig. 7 for intercon-

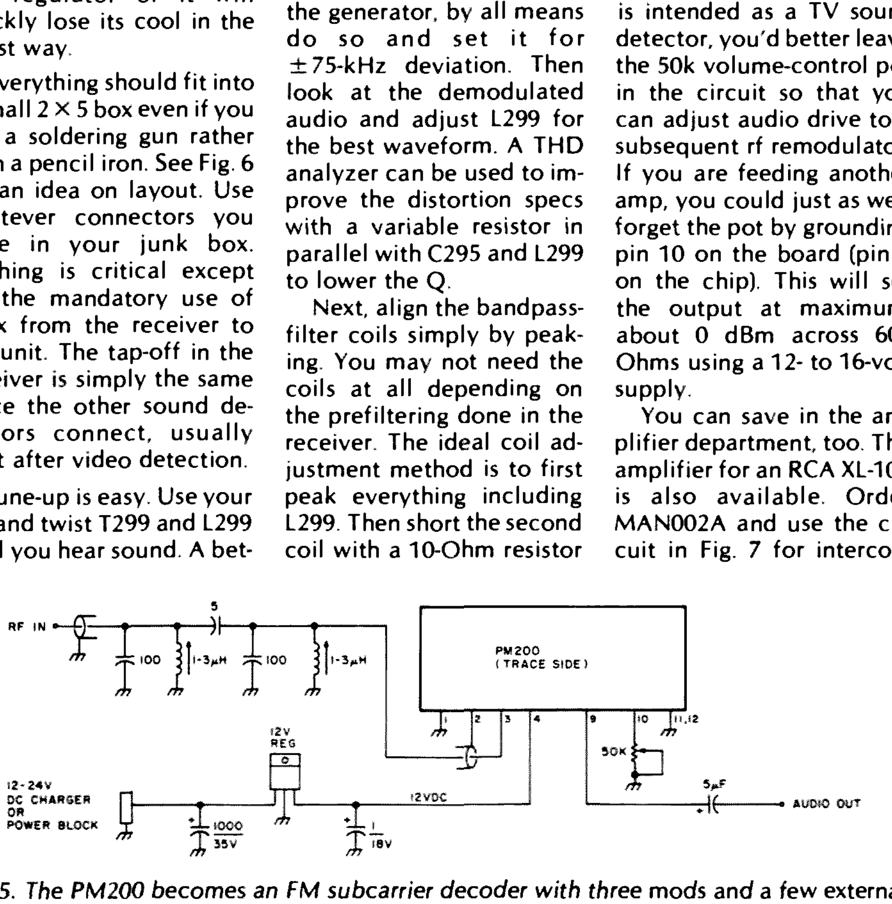


Fig. 5. The PM200 becomes an FM subcarrier decoder with three mods and a few external parts. Use your ear or an rf signal generator to tweak it into operation. Forget the input bandpass network if the receiver already has a high-pass filter for subcarriers.

the matching decoupling section.

Construction

Add one half inch to the calculated length to allow for exposing the center conductor so it can be connected to the other element. See Fig. 2. Cut the jacket, shield, and dielectric with one cut. A sharp knife or X-acto® miter saw should be used to make the cut. After all the elements are cut to length, then cut the jacket back three-eighths of an inch and tin both the center conductor and shield using a 25-Watt iron—too much heat will melt the dielectric.

Now that all parts are tinned, solder the parts together with a maximum of one-eighth-inch separation between elements. After completion, check for shorts by visual inspection as the antenna is at dc ground. Excess flux should be scraped off, but do not use any chemical flux remover as it can contaminate the dielectric. The whip on the top is connected to both the center and shield. The matching section is a quarter-wave coax stub shorted at both ends and a piston trimmer capacitor. See Fig. 3.

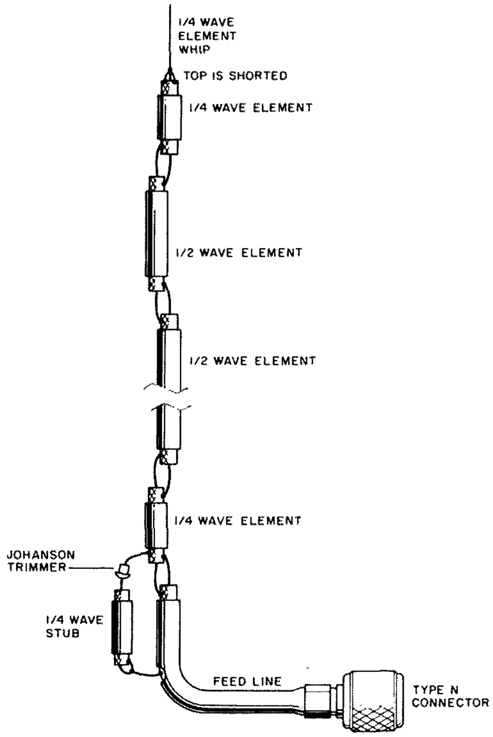


Fig. 3. 8 elements = 6 dB. 16 elements = 9 dB.

Tune-Up

Adjust the trimmer for minimum vswr. If the minimum is at one end of the trimmer, then adjust the spacing of the stub to feedline distance. One-eighth inch is normal for the spacing.

Housing

The antenna is housed in PVC pipe. The heavy wall is the one to use and it is also known as schedule 40 PVC. One-inch diameter can be used for either the 1241-MHz model or the 434 model, but if the antenna is to be mounted as a free-standing antenna, the 434-MHz housing should be tapered. This can be done with ¾-inch, 1-inch, and 1¼-inch pipe. The pipe may need to be heated to make a better fit. Pipe caps are used to keep the rain out of the housing and the bottom should be open so it can breathe. The antenna can be mounted one half wavelength from a mast for a cardioid pattern and the gain will increase 2 dB over that of an omnidirectional pattern. See Fig. 4 for the patterns.

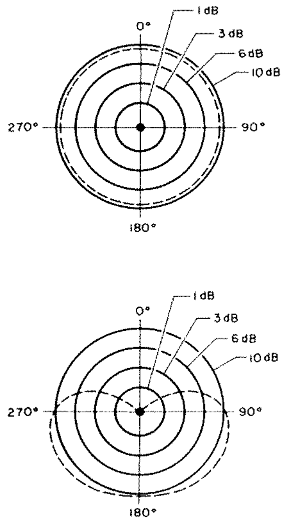


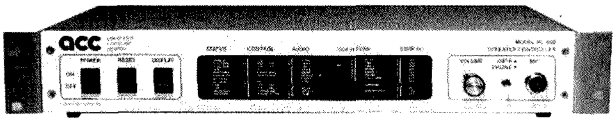
Fig. 4. (a) Omnidirectional pattern. (b) Cardioid pattern.

Conclusions

Construction time is one to two evenings. Take your time and you will have a better working antenna. The 434-MHz version has been in use for one year now on Mount Wilson and has survived all four seasons from 100 degrees heat to snow and ice. Many of these particular antennas in Los Angeles and San Diego have been built and used with the same results as I have obtained. Recently, a second 1241-MHz version was installed on Mount Wilson for the aural transmitter on the ATV repeater. It is identical to the one used for the visual transmitter and the results have been good.

Acknowledgements

I would like to thank Jay N6BDT for his help in testing the antenna, and also all others who helped me in this endeavor.■



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You probably have some idea of what a Zepp antenna is. It's end-fed with open-wire line and has to be tuned using a transmatch, right? Well, Zepp is a nickname applicable to many kinds of antennas. Generally, any end-fed, half-wave antenna is a variation of the Zepp.

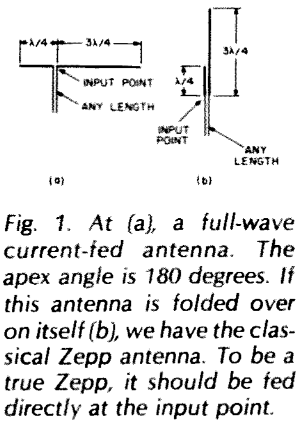

Fig. 1. At (a), a full-wave current-fed antenna. The apex angle is 180 degrees. If this antenna is folded over on itself (b), we have the classical Zepp antenna. To be a true Zepp, it should be fed directly at the input point.

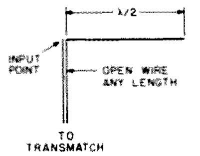

Fig. 2. The version of the Zepp most commonly used among hams. It operates at the fundamental and all harmonics.

How did they ever come up with a name like Zepp? How does the Zepp antenna work? Can you use a Zepp, or variation, to advantage at your station?

The True Zepp

The Zepp originated from the demand for an end-fed antenna that did not require a substantial ground to work against. At first thought, this might seem like an unrealistic idea. But it can be done.

Fig. 1 shows the evolution of the Zepp, so named because it was first used as an antenna dangled from a zeppelin! A full-wave antenna has a low resistive impedance when fed at a current maximum (a). Current feed of a full-wave antenna mandates that one side be 1/4 wavelength and the other side be 3/4 wavelength. The apex angle at (a) is 180 degrees, but smaller angles will work. The antenna will work even if the apex angle is zero degrees (b). When the apex angle is zero degrees, we in fact have a half-wave piece of wire fed at the end by a quarter-wave section of parallel-wire line.

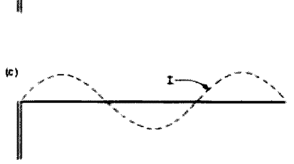

Fig. 3. Harmonic operation of the half-wave Zepp. At (a), operation on the fundamental (1/2-wave); at (b), second-harmonic operation (full-wave); at (c), third-harmonic operation (3/2-wave).

At the input point of the transmission line in Fig. 1(b), the impedance is a pure resistance of a very low value. The quarter-wave piece of line, formed from the folding over of the original full-wave antenna, acts like an impedance transformer, bringing a high impedance down to a low one.

How the Zepp Works

The radiating part of the Zepp is, of course, the half-wave part extending past the parallel-wire line. One end of the line is just left hanging. How can this work?

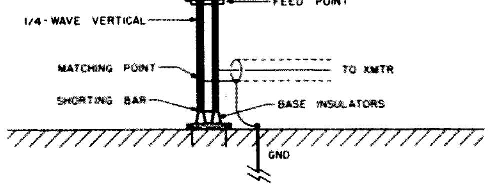

Fig. 4. The J-pole. The bottom end is shorted and the matching point adjusted for minimum swr at resonance. The height of the matching section in feet is 2.80/f, where f is given in MHz. The overall height of the structure is 700/f. This is a monoband antenna.

above utility lines. Also, some guy back in the 1700s already proved that thunderstorms contain electrical energy. There is no need for you to prove it again.

Conclusion

The Zepp is versatile because end feed is physically convenient. This results in some line radiation, but if the antenna is located wisely and cut to the proper length, this problem is not serious.

The Zepp may be operated at any harmonic, although the bandwidth tends to be narrow. As a rule, consider the useful bandwidth of a Zepp to be 50 kHz either side of resonance, whether it is operated on the fundamental or a harmonic. Example: A Zepp that is a half wavelength at 7050 kHz may be used between about 7000 and 7100, 14050 and 14150, 21100 and 21200, and 28150 and 28250 kHz. (Outside these ranges, the antenna will work, but there will be significant radiation from the feedline.)

Now dig out those old porcelain insulators (you *did* save them, didn't you?) and that 300-foot roll of stranded no. 14 copper wire you bought last year at Dayton for $1.50 and thought you could never use. Hang a Zepp someplace! ■

Notes

[1] For wire antennas, use the formula: length (feet) = 468/f, where f is given in MHz, for the length of a half wave. This is only approximate and may have to be pruned, but it represents the best average value.

[2] After the antenna has been cut according to the formula, you can find its resonant frequency by using a field-strength meter placed a few feet from the feedline near the transmitter. The resonant frequency is the frequency where the field strength is minimum, indicating minimum line radiation. Then, the antenna may be pruned until its resonant frequency is as desired.

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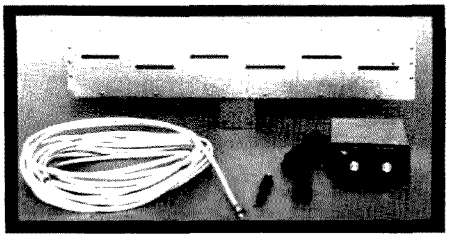

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The voltage at the end of the half-wave radiator is applied across a theoretically infinite impedance, which causes rf current to flow along the wire. It's kind of like shaking the end of a loose clothesline to make waves up and down the rope; although we never actually *pull* on the rope, the waves nevertheless occur along its length.

In theory, the Zepp is a balanced antenna because the impedance is infinite both at the free end of the line and at the terminated end. In practice, however, there is no such thing as an infinite impedance. The impedance at the free end of the line is *extremely* high, that at the terminated end is *very* high. They're a little different, and this unbalances the currents in the feedline. Consequently, the line radiates to some extent. This radiation can be minimized by ensuring that the impedance at the feedpoint is a pure resistance and is as high as practicable. This requires that the radiating part of the Zepp be *exactly* a half wavelength long,[1] and also that the antenna be placed as much in the clear as possible, to maximize the impedance at the ends of the radiating length of wire.[2]

Yet, even if we dangle this contraption from a zeppelin at 40,000 feet, it won't be perfectly balanced. The feedline will invariably radiate a little energy. A properly operating Zepp is not too bad about this—it's almost as good as a center-fed antenna.

The Usual Zepp

Most hams who use a Zepp have an installation something like that shown in Fig. 2. With this kind of system, a transmatch is necessary since we don't know what the impedance will be like at the station. This kind of Zepp will work at the fundamental frequency (the band where it's 1/2 wavelength) and all harmonic frequencies. At any harmonic, the Zepp has a current node at the feedpoint. Harmonic operation of the Zepp is shown in Fig. 3.

The Zepp is somewhat temperamental about departures from its resonant frequency. Even a tiny change in frequency will move the current node away from the feedpoint—either out onto the radiating part of the antenna (frequency too high) or down into the transmission line (frequency too low). But the node at the loose end of the line cannot move. The result: line radiation! The Zepp is a narrowband antenna.

What if you have no transmatch and do not exactly feel like running out to your local ham shop and plunking down a hundred dollars or so to buy one of those fancy things they're selling nowadays? Can you still use a Zepp? Definitely. Fig. 4 shows one way to get a good match to 52- or 75-Ohm coaxial cable. Fig. 5 illustrates a second method. When the correct matching point is found, the swr is 1 at resonance.

Vertical Sans Radials

Of course, we can orient a Zepp in any direction we want. Figs. 4 and 5 show two vertical Zepp antennas. The antenna in Fig. 4 is often called a J-pole and is fairly common at VHF. But it is practical down to about 20 meters, and if you're ambitious, you might want to try building one for 40. In Fig. 5 is a method of feeding a half-wave radiator. This is definitely practical down to 40 meters. Both of these schemes constitute Zepp feed. Both of these antennas are monobanders, though, because of the matching technique used.

These antennas do not need any radial system. In both instances, the base impedance is very high and thus ground loss is kept to a minimum. Adding radials to the antenna in Fig. 5 will improve its performance, because of the gain resulting from the image signal. (This will provide the equivalent of a 2-element collinear.)

Other Zepps

A half-wave sloper may be fed at the end instead of in the center. The performance of the antenna will be the same in either case. This is shown in Fig. 6(a).

Zepp feed, because of its convenience, allows an exotic method of getting the antenna up in the air. This is shown in Fig. 6(b). The feedline should be TV-type twinlead, in order to minimize the weight, and the kite may have to be pretty big. But this idea has been used successfully on 160-meter endeavors when the wind is strong enough! One word of caution: Make sure the system is not flown

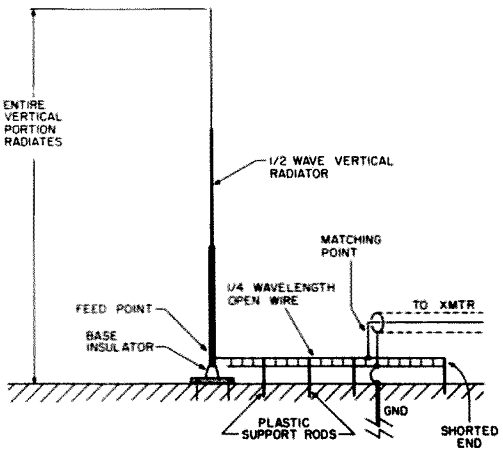

Fig. 5. Zepp feed for a half-wave vertical. The length of the open-wire matching section in feet is 275/f. (Don't use TV twinlead!) Adjustment of the matching point is required; a good starting point is 1/6 of the way from the shorted end to the antenna end of the matching section for this antenna and for the J-pole.

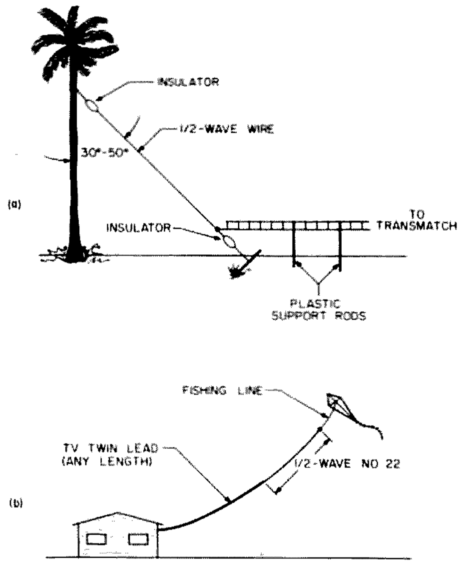

Fig. 6. At (a), end feed for a half-wave sloper. At (b), well, end feed for a half-wave sloper! These antennas will work at the fundamental and all harmonics.

SOCIAL EVENTS

from page 90

.34/.94. For more info, advanced reservations, or raffle tickets, send an SASE to Jerry Frederick N0BNG, 1127-104th Avenue West, Duluth MN 55808.

LUFKIN TX
MAY 14-16

The Region Four Air Force MARS will hold their annual convention on May 14-16, 1982, at the Ramada Inn, Lufkin TX. Friday night there will be an administrative meeting of all headquarters personnel and all Region Four officials, and Saturday there will be a series of programs. A banquet will be held on Saturday night. For further details, please contact Ed Langston AFA4KH, Convention Chairman, 1123 Sayers Street, Lufkin TX 75901.

CADILLAC MI
MAY 15

The 22nd annual Swap Shop & Eyeball QSO will be held on Saturday, May 15, 1982, from 8:00 am to 4:00 pm at the Wexford Civic Arena, US 131 North, Cadillac MI. Tickets are $2.50 and 8-foot tables are $4.00. There will be prizes, plenty of parking, and lunches available. Talk-in on 146.37/.97. For further information, contact Wexaukee Amateur Radio Association, PO Box 163, Cadillac MI 49601-0163.

DURHAM NC
MAY 15

The Durham FM Association will hold the annual Durhamfest on May 15, 1982, at the South Square Mall, US 15-501 south, Durham NC. Admission is $3.50 with no additional charge for tailgating or dealers' spaces. Features will include prizes and a flea market. Motels, a restaurant, facilities, tables, and power will be available. Talk-in on 147.825/.225. For more information, write Durhamfest, Box 777, Hillsborough NC 27278.

ROGERS AR
MAY 15

The Northwest Arkansas Amateur Radio Club, Inc., will hold its 2nd annual hamfest/swapmeet on Saturday, May 15, 1982, from 8:00 am to 4:00 pm at the Community Building (Old Armory), US Hwy 71, Rogers AR. Commercial exhibitors' and flea market tables and spaces are free. Doors will open at 6:00 am for setup. Main prize tickets are 3 for $5.00 or $2.00 each and prizes include a complete Kenwood station consisting of TS-130S, ac power supply, and MC-50 mike. There will also be door prizes, free parking, and programs, including MARS, DX, and Skywarn. Talk-in on 146.16/.76 or 146.52. For more information, write Mary Webb KA5HEV, PO Box 338, Prairie Grove AR 72753, or call (501)-846-2847.

BATON ROUGE LA
MAY 15-16

The Baton Rouge Amateur Radio Club will hold its annual hamfest on Saturday and Sunday, May 15-16, 1982, at Catholic High School, 855 Hearthstone Drive, Baton Rouge LA. There will be swap tables, dealers' exhibits, technical forums, and activities for the non-ham wives and children. Talk-in on .19/.79 and .52 simplex. For further information, write BRARC, PO Box 4004, Baton Rouge LA 70821.

ATHENS OH
MAY 16

The Athens County ARA annual hamfest will be held on Sunday, May 16, 1982, from 8:00 am to 4:00 pm at the Athens City Recreation Center, East State Street, Athens OH. There will be a free flea market for electronics-related items on a large paved area and some indoor space available on a first come, first served basis. Setup is at 7:00 am. Food, free parking, and several nearby restaurants will be available. Tickets are $1.00 in advance and $2.00 at the gate. Talk-in on .34/.94. For further information, send an SASE to ACARA, PO Box 72, Athens OH 45701, or phone Joe Follrod WB8DOD at (614)-797-4874.

MARSHALL MO
MAY 16

The Indian Foothills Amateur Radio Club will hold its 7th annual hamfest on May 16, 1982, at the Saline County Fairgrounds building, Marshall MO. Tickets are $2.00 each or 3 for $5.00 at the door, or 5 for $5.00 in advance. There is no charge for tables but reservations are requested. Registration will be at 8:00 am and coffee and breakfast rolls will be available from 8:00 am to 10:00 am. Lunch (all you can eat) will be at 11:30 am. The drawing will be held at 2:30 pm with a first prize of a KDK 2025 Mark II. Talk-in on .52, .28/.88, and 147.84/.24. For additional information and advance tickets, contact Jim Little KB0DA, 405 E. Rosehill, Marshall MO 65340, or call (816)-886-8583 after 5:00 pm, or K0BVB at (816)-886-2837.

EASTON MD
MAY 16

The eighth annual Easton Amateur Radio Society Hamfest will be held on May 16, 1982, rain or shine, from 8:00 am to 4:00 pm at the Easton Senior High School cafetorium, Rte. 50, just south of Easton at mile marker 66. The donation is $2.00 with an additional $2.00 for tables or tailgaters. Talk-in on .52 and 146.445/147.045. For more details, write Van Herridge WB3HGQ, Box J, St. Michaels MD 21663 or Easton Amateur Radio Society, Inc., Box 781, Easton MD 21601.

WEBSTER MA
MAY 16

The Eastern Connecticut Amateur Radio Association will hold its 8th annual flea market and auction on Sunday, May 16, 1982, starting at 9:00 am, rain or shine, at the Point Breeze Restaurant, Webster Lake, Webster MA. Admission is $1.00 and table reservations are $5.00 in advance or $7.00 at the door. Food and drinks will be available as well as free parking. The auction will be held at 1:00 pm. Talk-in on 147.885/.285 K1MUJ and 146.52. For reservations and additional information, contact Dick Spahl K1SYI, Lake Parkway, Webster MA 01570, or phone (617)-843-4420 after 7:00 pm.

WABASH IN
MAY 16

The Wabash County Amateur Radio Club will hold its annual hamfest on Sunday, May 16, 1982, from 5:00 am until 4:00 pm at the Wabash County 4-H Fairgrounds, Wabash IN. Admission will be $3.00 at the gate or $2.50 in advance. There will be plenty of food and parking available, as well as free overnight camping on Saturday. Talk-in on 147.63/.03 or 146.52. For tickets or more info, send an SASE to Dave Spangler N9ADO, 45 Grant Street, Wabash IN 46992.

EVANSVILLE IN
MAY 16

The Tristate Amateur Radio Society (TARS) will hold its annual hamfest on Sunday, May 16, 1982, beginning at 6:00 am CDT at the Vanderburgh County 4-H Center, Evansville IN. Admission is $2.00. Tables will be available in the air-conditioned indoors. An outdoor flea market will also be featured. Talk-in on 147.75/.15 and 146.19/.79. For additional information and table reservations, contact Hal Wilson WB9FNN, RR 8, Box 427B, Evansville IN 47711.

WRIGHTSTOWN PA
MAY 16

The Warminster Amateur Radio Club will hold its annual hamfest on Sunday, May 16, 1982, from 7:00 am to 3:00 pm at the Middletown Grange Fairgrounds, Wrightstown PA, near Philadelphia. Admission is $3.00 at the gate with an additional $2.00 for each 8-foot seller's space. Children and spouses will be admitted free. If pre-registered by May 1, 1982, the admission fee will be $1.00 less. Door prizes will be awarded every half hour beginning at 9:00 am. Talk-in on 147.690/.090 and 146.520. For more information, write PO Box 113, Warminster PA 18974, or call Bill Scott KA3CHB at (215)-249-0568 after 6:00 pm.

FRESNO CA
MAY 21-23

The Fresno Amateur Radio Club, Inc., will hold its 40th annual hamfest on May 21-23, 1982, at the Hacienda Inn, Clinton and Highway 99, Fresno CA. The full advance registration cost is $20.00. On Friday, activities will include registration, a golf tournament, and wine tasting; on Saturday, swap tables, commercial exhibits, a luncheon program, a CW contest, MARS meetings, a transmitter hunt, a No Host Cocktail Hour, and a banquet with speaker, Dr. Henry Richter; on Sunday, a

WPSS Breakfast. Talk-in on 146.34/.94. For advance registration or more information, contact the Fresno Amateur Radio Club, Inc., PO Box 783, Fresno CA 93712.

GORHAM ME
MAY 22

The Portland Amateur Wireless Association and the Southern Maine University Radio Club will hold their annual flea market on May 22, 1982, from 8:00 am to 4:00 pm (inside if it rains) at the Gorham ME campus. The cost is $1.00. Food will be available. Talk-in on 146.73R and 146.52S. For additional information, write John Taylor N1SD, 44 Milton Street, Portland ME 04102, or call (207)-773-2651.

GREEN BAY WI
MAY 22

The Green Bay Mike and Key Club will be holding its seventh annual swapfest on Saturday, May 22, 1982, from 8:00 am to 3:00 pm at the Norwood School, Norwood and Ninth, Green Bay WI. Admission is $1.50 in advance by May 1st, and $2.00 at the door. Table space is $2.00, and there will be one free admission for every 2 tables bought. Door prizes will be given away and food and beverages will be available. Talk-in on 147.72/.12 and 146.52. For more information, contact Bob Duescher KA9BXG, 1011 13th Avenue, Green Bay WI 54302 or phone (414)-497-7880.

WEYMOUTH MA
MAY 22

The South Shore Repeater Association will hold its ham radio/electronic/computer flea market on Saturday, May 22, 1982, at Weymouth South High School Cafeteria, 300 Pleasant Street, Weymouth MA. Admission is $1.00 for each buyer and tables are $5.00 in advance or $8.00 at the door. Doors open for sellers at 9:00 am and for buyers at 10:00 am. Food and refreshments will be available. For directions or table reservations, please contact SSRA, c/o David Newman, PO Box 447, Abington MA 02351.

KNOXVILLE TN
MAY 22-23

The 1982 ARRL Delta Division Convention and the sixteenth annual Knoxville Hamfest will be held on Memorial Day Weekend, May 22-23, 1982, at Bearden High School, Knoxville TX. Forums will be on the future of amateur radio, DXCC, the CQ 5B-WAZ program, fast-scan TV, computers and amateur radio, and the ARRL. Other activities include programs for non-ham ladies, a shuttle bus to the World's Fair, an indoor and outdoor flea market, an exhibit area, and the verifying of QSL cards by Don Search W3AZD and Bob May K4SE. Both 4-land QSL bureaus will be in attendance and cash prizes will be offered in the Ron McKean Memorial CW competition. For more information, please write Delta Division Convention, c/o Ray Adams N4BAQ, 5833 Clinton Highway, Suite 203, Knoxville TN 37921, or phone (615)-688-7771 (days) or (615)-687-5410 (nights).

HARTWELL GA
MAY 22-23

The Anderson, Hartwell, and Toccoa Amateur Radio Clubs will hold the 4th annual Lake Hartwell Hamfest on May 22-23, 1982, at the Lake Hartwell Group Camp, located on Highway 29, 4 miles north of Hartwell GA. Features include free admissions, free camping, and free flea market space. Activities include a left-footed CW contest, horseshoes, bingo, and many other activities for the whole family. Fishing, swimming, and camping are available on the site. The campground will open at 6:00 pm Friday and the main prize drawing will be held at 2:00 pm Sunday. Talk-in on 146.19/.79, 147.93/.33, and 146.895/.295. For further information, contact Ray Pettit WB4ZLG, Rte. 1 Dooley Drive, Toccoa GA 30577.

BOULDER CO
MAY 23

The Rocky Mountain VHF Society will hold the annual spring hamfest on Sunday, May 23, 1982, from 9:00 am to 3:00 pm, rain or shine, at the Boulder National Guard Armory, 4750 North Broadway, Boulder CO. The admission donation will be $2.00 per family and there is no seller's charge. The gates will open for sellers at 8:00 am and they suggest you bring your own table. The door prizes will include a synthesized FM transceiver, and extra raffle tickets will be available. In addition to the big ham swap, there will be technical demonstrations and seminars, covering topics such as fast-scan ham TV, microwaves, satellite communications, etc. Food and drink will be available. Talk-in on 146.16/.76 and 146.52. For more information, contact Richard Ferguson KA0DXM, 1150 Albion Road, Boulder CO 80303, or phone (303)-449-2871.

NATCHEZ MS
MAY 23

The Old Natchez Amateur Radio Club (ONARC) will hold its hamfest on Sunday, May 23, 1982, at the Natchez Convention Center, Natchez MS. Doors will open at 8:00 am and there will be food available as well as free admission and free swap tables. Talk-in on 146.31/.91. For further information, contact S. W. Gates N5AXV, PO Box 203, Natchez MS 39120.

ISLIP LI NY
MAY 23

The Long Island Mobile Amateur Radio Club will hold the ARRL Hamfair '82 on May 23, 1982, at the Islip Speedway LI NY. General admission is $2.00 and $5.00 per car space will be charged for exhibitors. Food and refreshments will be available at the track. There will be door prizes and special prizes drawn all day from 9:00 am to 4:00 pm. Talk-in on 146.85 (a 4Z PL will extend your range into New York City). For more information, call Sid Wolin K2LJH at (516)-379-2861, or Hank Wener WB2ALW at (516)-484-4322 in the evening.

BURLINGTON KY
MAY 23

The Northern Kentucky Amateur Radio Club will hold its annual Ham-a-rama on Sunday, May 23, 1982, at the Burlington Fairgrounds, Burlington KY (off 275, Burlington-Florence exit). Individual tickets are $4.00, family tickets are $6.00, and each ticket entitles you to the major prize drawing at 4:00 pm. First prize is a Kenwood low-band TS-130S or $500, second prize is a Kenwood HC-10 station clock, and there will be a special raffle for an Icom 2AT. Features will

Continued on page 146

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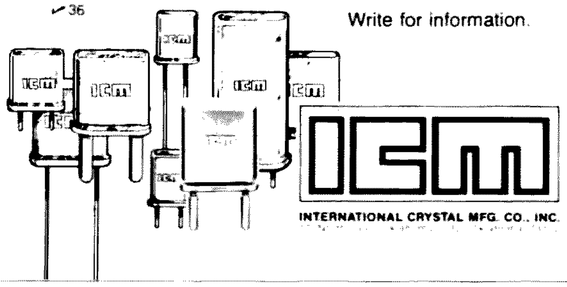

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Surviving the Unthinkable

—part I: the ham's role

Today they hauled out the last of the Civil-Defense supply cans from our office building. It wasn't much of a loss, however, because long ago the familiar drab green cans with their black lettering had been emptied of their contents. Once they had stored food, water, medical supplies, radiation-monitoring equipment, clothes, etc., enough material for several hundred people to survive for two weeks after a worldwide nuclear holocaust.

The fallout shelter sign is a symbol of protection which is now giving way to crisis relocation plans.

But the food grew rancid and the other materials deteriorated. With several reorganizations of the building, the cans constantly were reshuffled into corners until, finally, there was no other place to put them but out with the trash. Tonight they most likely grace the garage of a member of the maintenance staff who saw them as too good to discard and recovered them to use for workshop trash, discarded cuttings from his table saw, or some such refuse.

The case here is common. The once-familiar sight of fallout shelter supplies gracing the basements of public buildings has all but disappeared. Only a few of the once-common fallout shelter signs remain. Most likely, if you care to check a building displaying a shelter sign, you will find plenty of shelter and no usable supplies.

So, what would happen if our nation's 225 million people suffered an attack by a nation using nuclear warheads? Are we totally unprotected? Out of luck? Frankly, according to civil-defense planners, people heading for those old-style shelters might be out of luck, anyway. The shelters are often located in downtown areas of large metropolitan areas. With a direct hit to one of these cities, it is very likely that the shelter would provide as much protection to its occupants as no shelter at all. Cities where this problem is expected to occur are shown

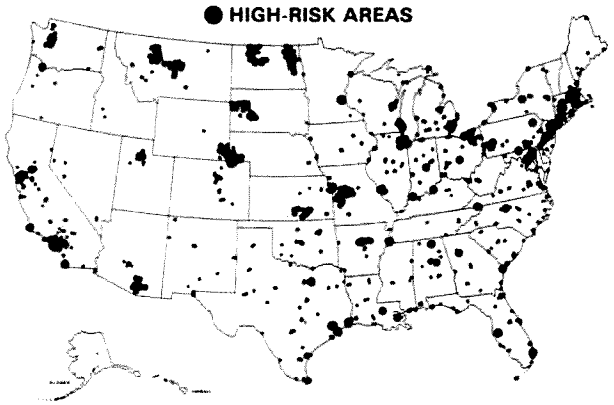


Fig. 1. The dots here represent possible high-risk areas which require crisis relocation plans.

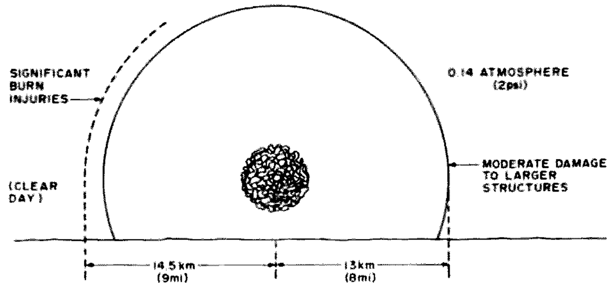


Fig. 2. Expected effects of 1-megaton air blast.

in Fig. 1, which is a map of cities most likely to receive direct hits in an all-out nuclear war.

The idea of these home cities being targets of some foreign nuclear power is not a pleasant thought. But in a world of increasing tensions, there no doubt will be an increased interest in our praying for peace, and also preparing for our own personal defense in the event our world leaders some day fail to keep the peace.

As an alternative to hiding in big-city shelters, planners suggest that it may be better to move people out of the crucial areas where devastation is most likely to occur. (Fig. 2 shows the sphere of effect for each 1-megaton device.) This plan is apparently patterned after a Russian plan discovered several years ago.

According to a recent publication of the Federal Emergency Management Agency, which now handles civil defense, the new plan is as much a negotiation plan as anything. They feel that in a game of superpower brinksmanship, where each side will see just how far the other will go before "pushing the button," the Russians would most likely evacuate their cities as a defense mechanism before launching an attack on us. Naturally, the planners feel our intelligence sources would let us know of the evacuation. At that point, we would rely on our country's availability of rapid transit and family cars to completely evacuate before the Russians do. We would then declare that since we're safe and they're not, they should back off and forget about blowing us to oblivion.

There are some good points about the plan. It is true that the United States has great versatility due to our widespread use of private cars, while the Russians cannot afford to have a car in every garage and would need to rely on trains, buses, and "marching routes" to move their people 30 to 200 miles from major cities. An illustration of their plan is shown in Fig. 3. The weather, however, complicates survival, as shown in Fig. 4.

Calculating the cold hard facts and the alternatives of attack plans, civil-defense authorities in the US figure that if the Russians attacked before evacuating, they would lose about 100 million civilians. On the other hand, if they evacuate first, they would lose a mere 20 million.

A non-classified Federal Emergency Management Agency report issued in October, 1980, states five key points about a Soviet attack strategy.

"1) The Soviets probably have sufficient blast-shelter space in hardened command posts for virtually all of the leadership elements at all levels (about 110,000 people).

2) With a few hours of warning or less, the Soviets would suffer over 100 million casualties, but a large percentage of the leadership elements probably would survive.

3) With 2 or 3 day of preparation, the Soviets would suffer less than 50 million casualties.

4) With a week (or more), they would suffer casualties in the low tens of millions.

5) Therefore, the critical decision to be made by the Soviet leaders in terms of sparing the population would be whether to evacuate cities. Only by evacuating the bulk of the urban population could they hope to achieve a marked reduction in the number of urban casualties."

The same reasoning applies to the United States. The most horrifying part of the statistics is that at the very least we're talking about tens of millions of lost lives. And that doesn't count radiation sickness, burns, exposure, starvation, etc.

The United States system was scheduled to be in place for most all cities during 1981. Under the system, planners believe that 80% of our population would survive to rebuild. Again, they do not estimate the aftereffects of such a disaster on the survivors of any nation.

Even after the plans are completed, there will be much additional work to be done: Shelters need to be constructed; managers need to be trained; tests of the system must be made, followed by evaluation of the tests and redirection based on the results of the tests.

Amateur radio is not mentioned in the FEMA publication sent to me regarding the crisis relocation plan. The response I received from an FEMA official states, "Those amateur radio operators who operate with Radio Amateur Civil Emergency Services (RACES) are still a very important part of civil preparedness. RACES licenses as such are no longer being issued by the FCC, but each RACES operator uses his own call letters. However, these persons must be recognized as part of the civil-preparedness organization in order to operate during emergencies under the auspices of RACES. Any RACES planning should be done with your own state of Iowa and the FCC."

Such planning is of little consolation to the residents of a state when they find out that nearly all of the state's (Iowa) 4,000 hams cannot operate, and the few licensed to operate the state's RACES station left the state one day ahead of a nuclear attack.

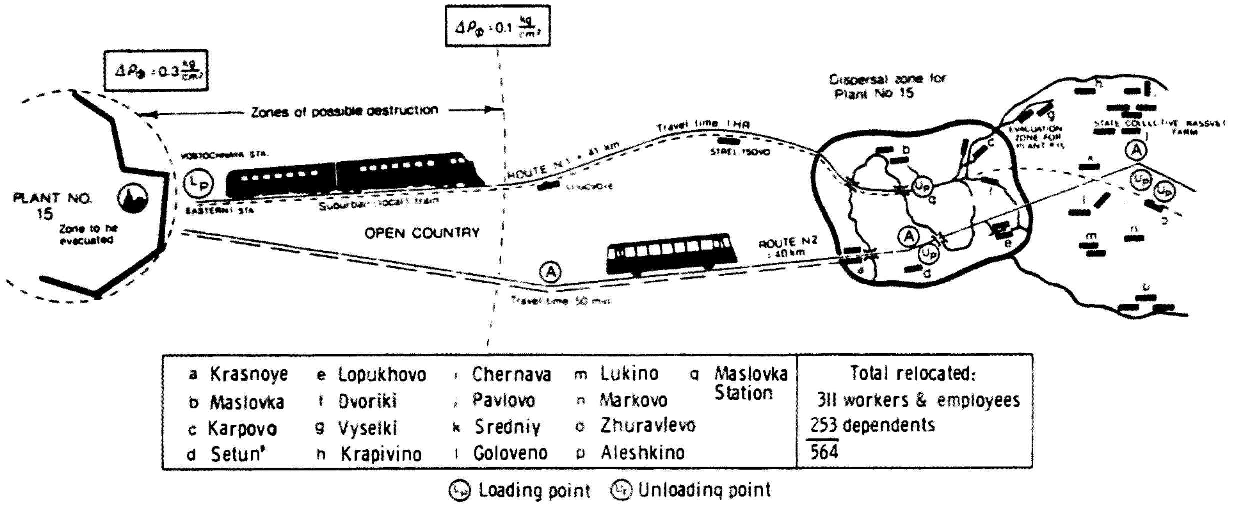


Fig. 3. According to the Federal Emergency Management Agency, this diagram shows Soviet plans for a crisis relocation program. The plan calls for dispersal of the population and daily commuting of workers to their places of employment.

By comparison, the May, 1980, issue of *73 Magazine* carried an article which described amateur activities when about 300,000 people came to Des Moines, Iowa, for an afternoon visit with Pope John Paul II. More than 150 local and statewide amateur radio operators provided excellent health and welfare services that day. The ratio of ham operators to population was about one amateur station for every 2,000 people. A substantially greater ratio was provided in areas where the sick and invalids were.

The situation in Des Moines was perhaps the best possible test of a crisis relocation program anywhere in the world since planners considered the notion of relocating hundreds of thousands of people. It was a complex program which was not easily undertaken. But on the specific point of supply of amateur radio operators, if the same ratio of amateur radio stations to population were applied to a national crisis-relocation program, *one out of every three* amateur radio stations in this country would need to be on the air in some assigned duty all the way from two meters through 160 meters. CW, FM, and SSB, in hundreds of orderly, planned, and tested networks, would be needed.

It is extremely unlikely that the present RACES system could come close to meeting the needs. As of December, 1979, there were only 610 officially licensed RACES stations on the FCC's books. We would need no less than 112,000 dedicated patriotic and very brave volunteers and their equipment.

The time is definitely here for amateurs to approach their local civil-defense authorities and the FCC to have this now-sophisticated service available on a widespread basis to every interested amateur radio operator in the event of a national emergency. Amateur radio is the only service which can provide a most-reliable communications system under severe circumstances when, for example, the entire telephone system would be rendered totally useless, merely because major switching locations would no longer exist!

Fig. 4. This is one of many possible distributions of fallout from a nuclear attack on the United States. The actual distribution would, of course, depend on the location and number of actual strikes and weather conditions.

Ham radio operators should be encouraged to improve their Morse-code capabilities, because under such strenuous situations, when even an amateur system may reach its peak in traffic-handling capabilities, every cycle of bandwidth of spectrum space is vital to the proper completion of the task. Currently, only CW operation can offer a bandwidth of just a few hundred cycles.

Right now, none of us, in our wildest dreams, can imagine how horrifying the world would be after a nuclear war. Our surviving population would need all the possible assistance that could be mustered, including medical supplies, food, and shelter, to name only a few. The existence of the top-notch amateur system like the one we now have could be the single most important item and could provide the key to our success.

In part II of this article, I will provide some details on just what can be done at each of our ham stations to lessen the danger to our communications systems. Some methods are simple, others incredibly expensive, but all of us can do something. ■

Acknowledgement

Figs. 1 through 3 are from *US Crisis Relocation Planning*, Federal Emergency Management Agency, 1980.

'AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

AWARD DIRECTORY

Countless letters and phone calls have been received regarding a proposed award directory, supposedly being sponsored by this magazine. To set the record straight and to avoid any further confusion, allow me to say that such a *73* publication just does not exist. That, of course, does not mean one will not be available in the distant future!

To attempt such an endeavor, the compiling of precise and up-to-date information becomes paramount and obviously the most difficult task. Unfortunately, too often, the author of such a publication has to be at the mercy of the various amateur radio clubs and organizations to provide him with the necessary input to make such a volume a reality. However, due to the apparent lack of interest of so many to submit information about their respective awards programs, we have almost discounted the idea altogether. Those who are theory-oriented will understand that no input is directly proportional to negative output!

However, to preserve the well-known Wayne Green tradition, "never say die," another attempt will be made to remuster the readership for their help to fill this void in our award files. We could use data on any award program you or your local club may be sponsoring, as well as any information regarding other award programs you may be aware of.

When you forward the various rules for each award, be sure to include an original of each award certificate so that it may be published in its entirety. After all, this is free advertising, ladies and gents! Don't you realize the exposure you'll be getting? The fact is, you will not have to pay $1500 per page as all advertisers have to just to get their message across to the readers. Take advantage of this unbelievable offer which only Wayne Green himself could extend to the readers of the most popular magazine in the hobby!

Send your award program rules and original award certificates directly to: Awards Directory, Attn: Bill Gosney KE7C, 2665 Busby Road, Oak Harbor WA 98277. Do not delay—send me your input today. Then, over the months ahead, perhaps we can put together the directory you've all been waiting for.

INTERNATIONAL AMATEUR RADIO SOCIETY

The International Amateur Radio Society (IARS) is an achievement, educational, public service, and amateur radio honor fraternity. It is the parent organization for the International Certificate Hunters Club (CHC), the International Shortwave Listeners Certificate Hunters Club (SWL-CHC), the International Amateur Radio Journalistic Society (IARJS), and the International Flying Hams Club (FHC), along with many affiliated subdivisions worldwide called either chapters or amateur radio associations.

The IARS publishes the *International Amateur Radio Society Annual*, which incorporates *The Directory of Certificates and Awards*, copyrighted internationally. The IARS also publishes the newsletter *Dialog*, through the IARJS, and the newsletter *Xtra*, the official house organ which reports news, special events, DX forecasts, and other items of interest to all members.

Through the CHC, the IARS sponsors many operating events, community services, achievement awards, and on-the-air nets. The IARS and its affiliates do not engage in partisan politics, but do take interest and action with regard to matters concerning the world's radio amateurs. It seeks to assist and cooperate with the many national amateur radio organizations (such as the ARRL, RSGB, JARL, etc.) in nations the world over. Although we may not always agree with what or how they do things, we acknowledge their efforts and lend them our support and participation.

The purposes of this organization are:

- to create and maintain an international communications system composed primarily of on-the-air amateur radio networks for all amateurs;
- to institute educational training programs and activities designed to advance the radio amateur's operating proficiency and technical knowledge, with emphasis on on-the-air gentlemanly conduct and compliance with the intent and interest of applicable national regulatory laws;
- to institute worldwide educational programs promoting improved human relations, international goodwill, and fellowship among men and women everywhere, without restriction or discrimination as to race, creed, color, national origin, political views, or religious belief;
- to promote the concept that shortwave listeners (SWLs) are fraternal kin to licensed amateurs and should be included in their programs and affairs;
- to promote the general welfare and survival of amateur radio as established under the International Communications Treaty;
- to publish educational books, magazines, newsletters, and literature in fields relating to international amateur radio; and
- to provide a comprehensive awards program, through the CHC, and to encourage and document the communication skills displayed by licensed radio amateurs and shortwave listeners.

The IARS, IARJS, CHC, SWL-CHC, and the FHC were created by Clif Evans K6BX in 1960 and have been protected as part of the copyrighted works of the Directory of Certificates and Awards. At the time of OM Clif Evans' death, the IARS, IARJS, CHC, SWL-CHC, and the FHC, along with 100 chartered, affiliated subdivisions called either chapters or associations, had over 22,000 members on the rolls, representing over 250 countries from all six continents.

They are making every effort possible to contact all of the members they have lost touch with since the death of Clif Evans and the closing of the old headquarters. Individual notification has been sent to each member via the bureau, and new club literature has been sent (via air mail) to all previous officials and office holders along with many national organizations and radio clubs around the world.

They look forward to all of their members around the world returning to active status.

The *International Amateur Radio Society Annual* is a yearly publication containing operating information and technical data, schedules of coming events of interest to the amateur community, net listings, DX tips, and much more. Included in the *IARS Annual* is *The Directory of Certificates and Awards*, the most comprehensive digest and guide to award-hunting ever offered to the amateur. The *IARS Annual* is also the organization's yearbook, offering a retrospective view on the past year and a look into the coming year, complete with IARS information on rules, codes, membership listings, and other items of interest to both the membership and amateurs at large.

The *IARS Annual* is published, revised, and updated annually in November, and covers in depth those topics not found in other handbooks. No amateur radio library is complete without it!

IARS Divisions Defined

IARJS: an international organization that provides a free and uncensored outlet for ideas, opinions, and proposals on behalf of amateur radio, through articles submitted by its members. These articles appear in the IARJS newsletter, *Dialog*, which provides its contributors an opportunity to inform radio amateurs throughout the world of conditions and situations affecting amateur radio. *Dialog* is a forum in which journalists and editors from around the world can exchange thoughts, ideas, and opinions on all matters concerning the future of amateur radio.

CHC: an international organization created to maintain an international communications system composed primarily of on-the-air amateur radio networks for all amateurs. The CHC also provides a comprehensive awards program and a vehicle for the procurement of awards from the many organizations around the world. Through its

system of networks, it provides the availability of contacts necessary for the achievement of these awards.

SWL-CHC: a mirror image of the CHC. SWL-CHCers seek the same achievement as radio amateurs except on a heard basis. All radio amateurs are also SWLs in half of all they do on the bands and are invited to participate in this division. The SWL-CHC also can provide the callsign necessary for QSLing through the bureau.

FHC: self-explanatory. Membership is available to any licensed radio amateur or SWL who holds, or has ever held, any nature of pilot's license or designation: aircraft, lighter-than-air vehicle, space, or glider.

Net Activity

CHC nets are 10, 15, 20, 40, and 75 meters as the demand dictates. Some of our nets are: CHC DX net, 0200 to 0500 UTC, 14.298 ± QRM, daily; CHC DX net, 1900 to 2200 UTC, 21.370 ± QRM, daily; and CHC Pacific family hour, 0000 to 0300 UTC, 21.370, daily.

Old CHC/New CHC

If you were familiar with the previous organization under Clif Evans K6BX, you will notice that they have instituted some drastic changes in both the way the club is handled and its value system. The new organization bears little resemblance in many areas to its predecessor, and they are sure you will find the changes to your liking. It is a blend of old and new and should be worthy of your review.

Membership is not a requirement for participation in either the awards program or any net activity. Membership is available with each division independently. Inquiries regarding membership are solicited. A bona fide interest in amateur radio is the only essential qualification (unless otherwise specified). When membership is attained, a membership number is issued which one holds *forever* regardless of change in name, call, QTH, class or license, or status of membership. Membership numbers and certificates are issued independently by each division. Membership in one division does not constitute membership in another.

Dues are payable during the first month of each year, January 1-31, following initial joining. Failure to pay dues will result in the member status being changed to inactive. Inactive members do not receive the newsletters, special club services, or voting rights when applicable. Inactive members always retain their original number. A member can go inactive in one division and still stay current in another. Payment of only present year's dues (not past) will restore any member to active status.

Newsletters are included with each membership, but are only available to members on active status. Articles are solicited from the members. They welcome information on all subjects pertaining to amateur radio, including hints and kinks, your local club's activity, awards issued by other organizations, etc.

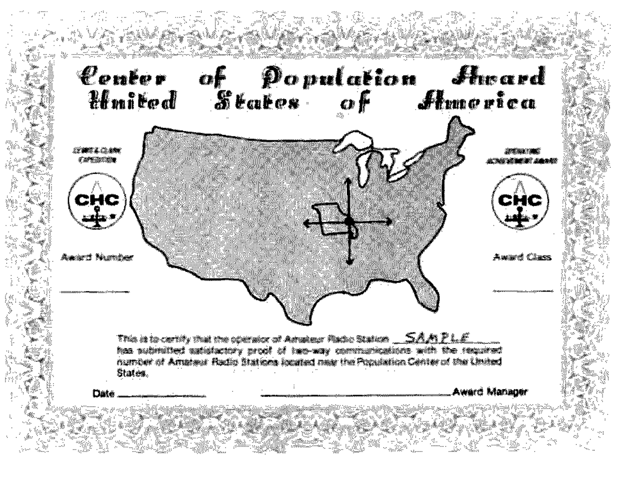
Certificates of membership are issued to each new member with the approval of their application. They are of the highest quality and are very worthy of display.

Fees/dues for the IARS, CHC, SWI-CHC, and FHC are as follows: joining each division—$6.00 (overseas—$7.00, no prorating); yearly dues, each division—$4.00 (overseas—$5.00), all due Jan. 1st.

For additional information about this complex organization, address all inquiries to: Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

CENTER OF POPULATION AWARD

The geographical population center of the USA is close to St. Louis MO. To achieve this award, work one station in each state which borders Missouri. Work one station in Arkansas, Illinois, Iowa, Kentucky, Kansas, Nebraska, Oklahoma, and Tennessee, plus one station in St. Louis MO. Send list showing calls and log data plus $1 to Dean Cowden KK0V, 2317 Lee St., Poplar Bluff MO 63901.



USA AWARDS PROGRAM

There is no limit to the frequency this award is issued an applicant. An applicant can work any band or mode of operation. Endorsements are $1.00 each. Application for this awards program should be made to Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

The Worked All United States Award is issued in four classes. Class AA is for DX stations only and requires the applicant to work all 50 US states. Class A1 is for domestic stations and they, too, must work all 50 states for this class of award. Class A2 requires 40 states be worked while class A3 requires 30 states be worked and confirmed.

There is a Double Worked All States Award and the only requirement here is that you work two separate stations in the required number of states for the class of award you are attempting to pursue.

Likewise, there is a Triple Worked All States Award for which you must work a minimum of three separate stations in each of the required US states.

While you are at it, consider the Worked US States and State Capitals Award. Here, points are accumulated for each state and capital city worked. A single point is earned for each. To qualify for class A (DX only), 100 points must be earned. Class B requires 80 points, while class D requires 60 points.

To add insult to injury, included in the USA Awards Program is the Worked All States, Capitals, and Counties Award. Here again, the award is based on a point system. Each state is worth one point, two points are earned for each state capital city worked, and a total of ten points is earned for working all counties in a single state. Should you accumulate 600 county points, a trophy will be awarded. The class AA award is given for 600 points, class A for 500 points, class B for 400 points, class C for 300 points, class D for 200 points, class E for 100 points, and class F for 75 points.

ALL ALASKA COUNTIES

The Moose Horn Amateur Radio Club of Penai Peninsula, Alaska, announces the availability of their award for the State of Alaska. The award, in the form of a certificate, is available to licensed amateurs worldwide.

Certificates will be issued with endorsements for special modes or bands such as: class 1 (CW), class 2 (AM), class 3 (SSB), class 4 (RTTY), class 5 (mixed mode), and suffixes A (one band) and B (mixed bands). For example, certification or endorsement for an award on 20-meter SSB would be class 3A.

To qualify for this award, applicants must make four contacts in Alaska, one for each of the four judicial districts of Alaska. Of these, one contact must be made with a member of the Moose Horn Amateur Radio Club. All contacts must be made on or after August 15, 1961. It should be noted that the present system of judicial districts will be used in lieu of counties until such time that the State of Alaska adopts a system of actual counties.

To apply for the AACA, provide a list of confirmed contacts, certified by either two amateur operators, a local radio club official, or a notary public. Forward the verified list along with one US dollar or three (3) IRCs to cover air mail return of your award. All applications should be addressed to Ken Smith KL7JFY, PO Box 1682, Soldotna AK 99669.

By the way, here is a list of the

members of the Moose Horn ARC: KL7EJM, EK, EKN, EKO, FG, GIC, GJY, GNP, HHF, HQK, IEL, IFX, IN, ISO, ISP, IQQ, IQP, IZH, JDR, JFY, JL, KJ, LB, LE, NH, AL7BU, WL7ACQ, AEG, AJF, WB9NES, and VE6NH/KL7.

USS LING

On May 8, 1982, the weekend before Armed Forces Day, so as to not conflict with the operations of the Armed Forces activities, the Meadowlands Amateur Radio Association will be on board the *USS Ling* (SS297), docked on the Hackensack River in Hackensack, New Jersey, and will be operating under club station call N2BMN. The operation will begin on Saturday, May 8, at 1500Z and end at 2100Z. The following frequencies will be operated throughout the day, alternative between CW, SSB, and FM:

MODE	FREQ.	BAND
CW	14.060	20m
SSB	14.310	20m
CW	7.115	40m
CW	7.060	40m
SSB	7.250	40m
CW	28.110	10m
CW	28.060	10m
SSB	28.650	10m
CW	144.100	2m
SSB	144.150	2m
FM	146.150	2m
FM	146.550	2m

For confirmation of QSO, please send a large SASE (8½" x 11") to Ralph Francavilla N2BMN, 154 Redneck Avenue, Little Ferry NJ 07643.

NETHERLANDS-AMERICAN BICENTENNIAL

The Holland (MI) Amateur Radio Club will operate K8DAA plus other participating stations for the Netherlands-American Bicentennial during Tulip Time, May 12 through May 16, 1982. Operations will be in all phone bands and possibly some CW. One contact with K8DAA (club station) or two participating stations qualifies for a certificate. QSL to: HARC, PO Box 92, Zeeland MI 49464.

ARMED FORCES DAY

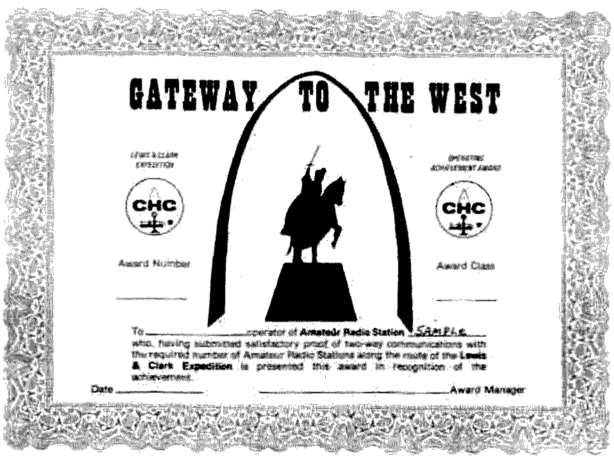
This year's observance of Armed Forces Day will include the operation of an amateur radio station from the United States Air Force Museum at Wright-Patterson Air Force Base, near Dayton, Ohio. Operating under the callsign K8DMZ, the station will be on the air from 1400Z to 2200Z on Saturday, May 15th. Operators will work primarily in the General class phone segments of 75, 40, 15, and 10 meters with periodic CW excursions to the Novice subbands. FM and SSB operations on 2 meters also are planned. The specific frequencies to be used will depend upon existing band conditions. To commemorate the event, the Museum will issue a special certificate for each two-way contact. This will be the first time an amateur radio has operated from the Museum in conjunction with a special event.

First established in 1923, the United States Air Force Museum is the oldest and largest military aviation museum in the world. It is located six miles northeast of Dayton at historic Wright-Patterson Air Force Base and is close to the Huffman Prairie site where the Wright Brothers conducted many experimental flights following their first successful powered flight at Kitty Hawk, North Carolina.

For further information, contact: Mr. Joe Ventolo, USAF Museum, Wright-Patterson AFB, Ohio 45433, (513)-255-3284, or the Museum's Public Affairs Officers, Dick Baughman or Linda Smith.

GATEWAY TO THE WEST ACHIEVEMENT AWARD

Work stations in states through which the Lewis and Clark expedition passed. Work one station in each of the following states: Idaho, Kansas, Montana, Nebraska, North Dakota, Oregon, South Dakota, and Washington, plus one station in St. Louis MO. Send list showing calls and log data plus $1 to Dean Cowden KK0V, 2317 Lee St., Poplar Bluff MO 63901.



CAPE HATTERAS LIGHTHOUSE I

The weekend of May 15 and 16, the Rockingham County ARC will be operating from the Cape Hatteras Lighthouse on the outer banks of North Carolina. This lighthouse, which at 208 feet is the tallest brick lighthouse in the country, is designated as a national historic landmark and is seen by over a million visitors each year. But this beautiful sentinel is in danger of falling victim to the Atlantic's turbulent forces. Once 1500 feet from the shoreline, it now stands less than 70 feet from the water—despite various efforts to control the erosion.

The RCARC hopes its mini-expedition will help to draw national attention to this graceful and historic landmark. Operating frequencies will be 30 kHz up from the bottom of the General portion in each band, both phone and CW.

CAPE HATTERAS LIGHTHOUSE II

When the Cape Hatteras Lighthouse was completed in 1870, it was 1500 feet from the shoreline. Today, it is 70 feet—and closing. The Cary Amateur Radio Club, Cary, North Carolina, will draw world attention to the peril of this keeper of the "graveyard of the Atlantic." On May 29-30, whether the lighthouse is still standing or not, Cary ARC members and friends will put two HF stations on the air from a site close to "the big candle." The targeted time for operation is 9:00 am (1300Z), Saturday, May 29, to noon (1600Z), Sunday, May 30, 1982. Operation may start sooner and last longer, depending on conditions and people power.

Planned frequencies for operation are: CW-3552, 7052, 14052, 21052, and 28052 kHz; SSB-3988, 7288, 14288, 21388, and 28588 kHz. The callsign will be NB4L (New Blood for Lighthouse).

Every station making a contact with NB4L during the special event can receive a commemorative 8.5" x 11" certificate by sending an appropriate SASE (1 oz., folded or unfolded) with QSL card containing the correct log information to Chuck Davis NB4I, 304 Atchison St., Garner NC 27529.

There is a public effort to raise funds to save the Cape Hatteras Lighthouse from the onslaught of the Atlantic. While many of the Cary ARC members may favor that project, this special event is only meant to focus attention on the peril of the Lighthouse. There is no connection with any fund raising.

SECOND ANNUAL COMMEMORATION OF MT. ST. HELENS ERUPTION

W7AQ, the Yakima Amateur Radio Club, will operate a special event station in commemoration of the second anniversary of the eruption of Mt. St. Helens in Washington State.

On May 18, 1980, at approximately 8:32 am local time, Mount St. Helens, located in southwestern Washington State, erupted violently. The 9677-foot summit was reduced to 8364 feet. A crater 2100 feet in depth was produced. Over one cubic mile of matter was thrown into the atmosphere.

Yakima, Washington, is located 80 miles northeast of the volcano. W7AQ was starting its hamfest activities that morning. By 10:30 am, the sky became as black as midnight. The light of the sun would not be visible until the next day.

Over 600,000 tons of volcanic dust and ash, which covered the city of 50,000 up to one inch in depth, was removed by cleanup over the next several weeks.

Join us in commemoration from May 16 at 1800 to 0200 of May 17 UTC. Frequencies will be 25 kHz up from the bottom of the General phone edge, ± QRM and band conditions. CW will be up 25 kHz from the Novice band

edge, ± QRM and band conditions and at 14.050 ± QRM and band conditions. A QSL will be available for an SASE. Send QSLs to: W7AQ, Yakima ARC, PO Box 9211, Yakima WA 98909.

MEMPHIS TN

The Memphis (TN) Radio relay Club will operate on May 22 and 23, 1982, for a weekend of the sixth Memphis in May Festival. Frequencies: CW—7,125 kHz ± QRM and 14,180 kHz ± QRM; SSB—7,280 kHz, 14,305 kHz, 21,400 kHz, 28,650 kHz, and 146.52 MHz ± QRM. Operating hours: 1400-2000 UTC, May 22, and 1200-1800 UTC, May 23, 1982. Special certificates will be issued for confirmed contact and large 9" x 12" SASE sent to N4ERU or N4CWS, 2071 Victoria, Memphis TN 38116.

PORT JERVIS, NEW YORK

The Orange County ARC will operate WB2TSA to celebrate the tenth anniversary of the club and the diamond jubilee of the city of Port Jervis, New York, on May 29 from 1400-2200 UTC and May 30 from 1400-2000 UTC. Frequencies 10 kHz up from lower general phone bands. QSL for SASE to OCARC, PO Box 434, Cornwall-on-Hudson, New York 12520.

DOGWOOD FESTIVAL QSO PARTY

The annual Dogwood Festival celebrated in Fairfield, Connecticut, will also be observed on the air by members of the Greater Fairfield Amateur Radio Association with its Dogwood Festival QSO Party on Saturday, May 8th. Members of the club will operate on six amateur bands with the club call WB1CQO and explain the significance of the festival, which marks the blossoming of the 30,000 pink and white dogwood trees in the town of 55,000 persons. Fairfield's Dogwood Festival began in 1936, although the original trees were imported from Japan in 1895 and earlier. Thousands of visitors flock to see the pink and white blossoms in full bloom during May.

WB1CQO will be on the air May 8 from 1300-2200 UTC (9:00 am to 6:00 pm) EDST. A special commemorative QSL card will be available to confirm each QSO.

Dogwood Festival stations will operate on these SSB frequencies: 3.975, 7.235, 14.330, 21.420 and 28.710 MHz. FM operation: 146.55 simplex.

Special QSLs will be sent upon receipt of an SASE or IRCs to QSL manager Grace von Stein KA1JT, 248 Euclid Avenue, Fairfield CT 06432, USA.

BISHOP MULE DAYS

The Bishop (CA) Amateur Radio Club will operate KA6AMT from the mule capital of the world, Bishop, California, on May 31st in recognition of the annual Bishop Mule Days celebration.

Frequencies: Phone—3.905, 7.240, 14.295, and 146.34/94. Certificate for a large SASE sent to Bishop Amateur Radio Club, PO Box 1024, Bishop CA 93514.

TIMBUCTOO

A special event station will be operated by the Yuba-Sutter Amateur Radio Club from the historic gold rush town of Timbuctoo, located in the mother lode country of California's Sierra Nevadas. Listen for callsign N6DDP from 1700Z May 15, 1982, to 0100Z, May 16. For a commemorative QSL, send an SASE to Y-S ARC, PO Box 1169, Yuba City CA 95992. Frequencies: 28.620-.630, phone; 21.150-.160, CW; 14.310-.320, phone.

MOSCOW OLYMPICS

The Moscow, Tennessee summer "Olympics" will be held in Moscow on May 14, 15, and 16, 1982. Communications for this annual event will be provided by the Mid-South VHF Club of Memphis. A special events station, KU4K, will be operating SSB from the site on 28.8, 14.28, and 7.2 MHz. There will be an OSCAR station in operation as well. Amateurs contacting KU4K are invited to QSL via Box 88, Moscow TN 38057. The summer Olympics is a benefit educational fund for the children of the men who lost their lives in the aborted Iranian hostage rescue attempt. Last year over $30,000 was raised for the benefit of approximately 17 children.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

against the speed of the brain and are stopped.

Once this limitation was understood, it made sense to stop trying to learn code with the old system. Articles were written about it and new code courses devised to get around that old slow method and the resulting plateau. I tried to get the ARRL to recognize the futility of their old system but got nowhere. Hams had always learned code that way and they were not going to change.

After giving up on the ARRL trying to help hams learn the code, I sat down and made up my own code tapes, using the new, much faster and easier, learning system. I brought these out on cassettes as the *73* Blitz Code Course. I soon was getting letters from thousands of new hams thanking me for breaking the situation for them. Many had tried and tried the ARRL tapes and had thought they were never going to learn the code. Now they found that within a few hours they were on top of it.

My "Genesis" cassette starts off the beginner with the simplest of code characters, starting with E, I, S, and H. Then, instead of going on to the rest of the 26 letters, I immediately start sending simple words. These characters are each sent at 13 wpm speed, right from the start, thus reinforcing the sound of the character. The letters are spaced for five wpm copying.

The quick change to sending words gets the student used to success. Simple messages are being copied within minutes of starting to learn the code. This is a tremendous psychological boost.

The first one-hour tape teaches all of the letters, numbers, and punctuation marks, complete with some cute messages to make the learning experience fun. Many people are thus able to master all of the needed characters within a couple of hours of work with this tape.

The next step is my "Stickler" tape. . .again with all characters sent at 13 wpm speed, but spaced for six wpm throughout. By standardizing on 13 wpm sound patterns, the groundwork is laid for passing the 13 wpm exam. The "Stickler" is all five-character code groups and has been designed by me to be as frustrating as possible. By the time you are able to copy this code tape 100%, you should be able to breeze through any FCC exam for 5 wpm, half drunk and in your sleep. Many hams tell me that by the time they can handle this nasty tape they can copy 13 wpm of clear text with no problems.

I want to be sure that my students are overtrained. The test, particularly if it is in front of an FCC examiner, can throw even a normal person into panic. Well, there is nothing which calms the nerves as much as sitting down to do a code test and having the code sound like it is coming at two wpm. It's all in the psychology.

For the next test, I have the most miserable tape you've ever heard. The "Back Breaker," at 14 wpm, will drive you right up the wall. You won't believe what a bastard I am until you try my "Back Breaker" tape and suffer. Heh, heh. But again, when you sit down for 13 per in plain text you will not believe how slow it sounds. Many students start laughing when they hear it, losing all their tensions.

Every now and then someone writes in asking for a copy of the code groups on my cassettes. I flatly refuse to send them a copy. The reason is simple. . .I don't want them using the tapes to test code-copying speed. The system is to use the tapes, picking out the characters you recognize. You keep working at this until you automatically copy all of them. You'll know full well

when you miss one, so you don't need a cheat sheet to check. I want you to practice without the pressure to perform. Such pressures take all the fun out of code. Learning the code should be and can be fun. The more you can do to make it fun, the faster you are going to learn it. The more pressure you put on yourself, the longer it is going to take and the more unpleasant it is going to be.

The fact is that a skill with the code is a lot of fun to have. I'm hoping that we can eliminate the pressures entirely by getting the code test out of the ham license requirements, replacing it with a technical exam which means something. Then I think we will have a lot more hams developing their code ability... and enjoying it.

For the Extra class license, I have a 21 wpm cassette. Once you can handle this one you will be able to copy plain language at almost 30 wpm.

From a practical point of view there is little difference in learning the code at 13 wpm, 20 wpm, or even 50 wpm. The process is about the same and the length of time it takes to master any of these speeds is about the same. We have had some interesting experiments with starting newcomers right out at 50 wpm... and succeeding!

The *73* code courses are available from us by mail order. They are also stocked by most ham stores. These stores are still selling the ARRL course...the one which I feel has lost us several hundred thousand hams. Many clubs are still taking hour after hour, struggling with the 1930s code system from the League. Modern ideas sure are difficult to get across.

FIGHTING BACK

Every now and then I get a stroke of inspiration. The other day, while I was sitting in the lounge of a restaurant waiting for my name to be called to get a table, a chap next to me started smoking a cigar. Being, as you may know, a non-smoker, I had immediate need of a gas mask. Cigarettes are annoying, but a cigar or pipe is just too much. I got up and went to another restaurant.

There must be some way to fight back. There really has to be a way. That was the train of thought that brought on one of my all too few strokes of semi-genius. If these turkeys can stink up the air I have to breathe, what's wrong with me stinking right back at them? How about an aerosol can of stink?

The first thought was to see about getting some cans of methane. Then I could sort of spray it and pretend that I fired back with a built-in weapon. But, alas, that might get ignited by the cigar or pipe and blow both of us to smithereens. No, the stink should be as offensive, but not be explosive. Perhaps skunk juice or hydrogen sulphide (rotten eggs). Yes, that would do it.

Put out in small pocket- (purse-) sized cans, I think it would sell. We might call it FIGHT BACK. It would be the first way for non-smokers to even the score. At $1 a can, it should sell well, Hmm, I'll have to look into this.

FOREIGN AID

One of the great benefits of amateur radio is that it allows us to sit and talk at length with hams in foreign countries. Unfortunately, few of us take the time to try to get to know amateurs in other countries, which is both our loss and theirs. Most of us are so swept up with contests and working countries that we say to hell with the chap at the other end.

I remember when I first moved to New Hampshire and went on the air. I found myself being called quite often by hams "needing New Hampshire." This quickly got to me. These chaps had no interest in me or in New Hampshire. All they were interested in was a QSL card. Now what is the possible value of a card from someone you didn't even bother to do more than casually bump into on the band? Hams needing New Hampshire seem to go out of their way not to get involved with any real conversation. They are almost always uninterested in paying any dues for the card in the way of an interesting contact. The QSL card is supposed to be the final courtesy. In this case, it is often the *only* courtesy involved.

Amateurs in all foreign countries run into this syndrome. In the rare ones, they seldom run into much else. If they get fed up with non-contacts with hams in search of their pasteboards and start making contacts by calling some of the stronger stations... or hams they know.. the hunters make their lives miserable with break-ins, tail-endings, and the like. If ignored, these QSL hunters can get vicious. This can diminish the fun of amateur radio substantially.

There probably isn't much that can be done about this whole lousy situation as long as the fascination continues for being high on the ARRL Honor Roll. Can I call it a dishonor roll?

At any rate, if you should want to fight the self-destructive urges to treat DX operators as mere QSL factories for your collection...providing you with an ever higher listing on an occasionally printed list in an obscure magazine and not much else to show for a lifetime of DXing...then perhaps you can join me in finding out that many DX hams are highly interesting people. I can tell you this: Once you start talking with them, you are sure to become addicted to it.

You know that in a country where there are from one to ten hams you are not likely to be talking with a blue-collar worker. It is highly likely that you will be talking with a relatively important or wealthy person. He is also likely to be particularly interesting, if you can get him to talk.

One of the conversational openers which I've found to work has to do with asking about their country. From there, I just sit back and listen. You know, it wouldn't hurt you to invest in one of the almanacs and read up on some of the smaller third-world countries so that you'll have some questions to ask which show more than a casual interest.

One of the subjects which may interest you has to do with aid funds the country is probably getting from ours. This can bring about an interesting conversation in some cases...and embarrassed silence in others. I have the advantage of getting around to visit hams in many of the third-world countries, so I ask about foreign aid when I visit them...and find many open to give vent to their feelings about this.

Since this is where I was heading when I started, it isn't exactly a digression. This business of foreign aid has been bugging me for a long time. The way the situation is set up right now, this money is wasted for the most part. It doesn't have to be.

As I wrote recently, the heads of a great many of the third-world nations are kept in position by virtue of the money they are able to grab for their supporters. Even the poorest of countries can be bled further by these pirates. But they are expert at working on the sympathies of the wealthier nations to get aid funds. The US is a particularly good sucker for this. Rarely does even 10% of this "aid" money accrue to the benefit of the poor people of the countries.

Presuming that Uncle Sap is going to continue to try to buy friendship (a commodity which seemingly can't be bought) with handouts, we could at least send aid which would be more difficult to turn into cash and at the same time provide some feedback of the money to US industries. My proposal is for future aid to take the form of goods, not cash, and that this should be goods from small business manufacturers rather than the big corporations. That would keep most of the lobbyists out of the pork barrel.

When we send cash, the most desired commodity, to these countries, most of it ends up in Switzerland without even coming near the people for whom it was intended.

Getting back to amateur radio, as you talk with the DX amateurs I think you'll find them enthusiastic for you to visit them. And I've found that a surprisingly high percentage of these amateurs manage to get to the US now and then. See if you can get them to include a day or two visiting you. Then you'll be able to find out a lot of things which they really couldn't talk about over the air.

Remember that 97.1e has to do with your ability to contribute to international goodwill. Pileups and tail-ending are not likely to do this. Presenting the friendly face of America to the world will. It's up to you whether we look like ugly Americans or not.

LETTERS

"CRACK THE WHIP"

First of all, I do *enjoy your* magazine and respect your right to an opinion on various topics (although sometimes I disagree), but on this business of a code-free license, I must make an objection.

I don't understand how Japan can have so many more amateurs than the US when the current *Callbooks* don't support this statement. But regardless, I will accept your word as you are in a better position than I am to know.

In my opinion, the reason why the US is declining in new engineers and high technology is because the youth of America is not made of the same fabric as that of our oriental brothers. At age 30, I *am* currently enrolled in an electronics program at a local community college and it is my impression that most of the "fresh-out-of-high-school" crowd are there merely because of parental pressure to get a degree. This school has one of the most thorough and modern electronics programs in the state and can compete equally with any big university on the educational level.

But the fact still remains that most of the younger students are "just going for a degree" and could really care less about the field they are pursuing. Possibly at one time they happened to open up a transistor radio, marveled at how it could do what it does, and *decided* this would be a less boring field than, let's say, social science or psychology.

The Japanese seem always to do things a little better, kind of a oneupsmanship, if you will, than their counterparts of the west. It is because they want to, Wayne . . .not because someone is standing over them with a whip!

If there is a minute problem with lids in Japan, what with their code-free licensing, that doesn't necessarily mean the same will hold true here.

You have stated that our technology could be much improved by technicians and engineers that were "sparked on" by being exposed to amateur radio during their youth. Well, if this is the case, then why didn't this happen with the Citizens Band service of the past? You couldn't have an easier way to get a ticket and get on the air than just to send off to the FCC for an instant license. Granted, a lot of superior hams graduated from the CB ranks and a lot of them probably went on to become technicians and engineers, but you know as well as I that the overwhelming majority did not. And look what the CB service is now without the *discipline*! Notice the emphasis on the word discipline? Learning code is a matter of discipline, period! There is no other word for it; that is it, in black and white. The Japanese are disciplined. As a matter of fact, they are noted for it. Maybe that is why they can handle a code-free licensing program without any problems.

How would you compare American youth to Japanese youth? Is one better than the other? No, but one is more disciplined. In WWII, we destroyed Japan and rebuilt it and, as a consequence, they became more disciplined. Given that fact, who do you think would be more arrogant? We have enough arrogance on the bands already. Let's try to get more discipline on the bands and not open up the floodgates for more arrogance. I don't think your theory holds too much water, Wayne. I teach new Novices and they *can* learn the code and *enjoy* doing so. It's just a matter of presentation and a little discipline.

It's been a while since this country has led the industry and I'm afraid it will be a lot longer until we can change the attitude of the people, especially that of the youth. Besides, if the overwhelming majority of hams today don't prefer a code-free license, why fight it? This *is* supposed to be our service, isn't it? We should have some say about how we want it! There will always be enough people to keep us a viable commodity on the FCC "exchange." And those are the ones we want. *Disciplined!*

Dave Peckham KD9D
Decatur IL

Dave, such a bunch of questions! Good ones, though, so let me tackle them one at a time. First, regarding the Callbook. *If they listed only the Extra class US hams, the US* Callbook *would be small, too. The Japanese* Callbook *is huge because they list all classes of licensees . . .over half a million of them. Now, about American kids and technology. . .the magic happens in the teen years. In the past, about 75% of the new hams were teenagers, with the old ARRL polls showing 50% being either 14 or 15 years old. There is now and there always has been an enormous difference between the type of engineer we get from dedicated teenage hams and from people who decide to just go for a degree. That's the same now as it always was and the chap who goes for a degree is usually a grave disappointment by comparison. Boy, I've known a lot of 'em.*

Now about CB. Dave, think about it. . .the mess is awful, with piles of interference, contacts which are even more boring than most ham contacts (yes, I know that's hard to believe), bodacious signals, and so on. . .how do you honestly expect anything good to come from such an incubator? The few CBers who managed to be salvaged by friendly hams are a blessing to us and to CB, but they are few, with most of those exposed to CB recoiling from the gore. No, there is a world of difference between an interference-hassled contact on one of the CB channels and a half-hour rag chew with someone in Germany or Australia, so please don't try to equate the two in your mind.

The Japanese aren't any better than we are. They just went the right way when we went the wrong with that foolish attempt to return to prewar Class A and B licensing in 1963. We now know how to fill our bands with crazies. . .use a code test and let Bash do away with the technical requirements with his books and blitz one-day memorization bashes. If you want garbage, you know how to get it. And Dave, remember that in 1969 the overwhelming percentage of the hams hated two-meter FM and didn't want to read about it or hear about it. Every now and then amateur radio needs someone to provide some leadership. I've found that in the long run people (even hams) will think things through and eventually get away from slogan thinking and work for what is in the long-range interest of amateur radio. We really couldn't ask for more proof that the code is a total failure as far as keeping out the nitwits (my apologies to any nitwits reading this and taking offense. . .which is an unlikely prospect) out of the hobby. Now that we have a way to easily cheat on the technical test, all we need is a way to cheat on the code and you have what you asked for: open sesame. I want to throw out the proven loser, code, and substitute a meaningful technical entry exam. . .one that can't be bashed.

If we get our spirit up, we can beat the hell out of any country in the world. . .including Japan. We can out-invent them, out-produce them, and out-quality them . . .if we decide that it is important to us. I want to get this started by getting kids infected with the ham bug when it is the easiest to pass along this infection: in high school. Dave, if we can get even half of the ham clubs to get some enthusiasm for selling amateur radio. . . classes. . .monitoring systems to keep our bands clean. . .emergency cadres so we will be ready to provide quick service for any kind of emergency. . .pressures on our high schools to start and support ham clubs. . .we'll be able to change the world in ten years. Or we can sulk and let amateur radio rot away the way it has for the last few years. Your choice. — Wayne.

CATCHING THE DREAM

Wayne, your editorials always ring my bell. You have the best interests of amateur radio at heart — we know that. I admire your business acumen; you are a true pioneer. I met you a couple of times at Dayton and enjoyed your magnetic and energetic personality.

Yet, agreement we don't have. You constantly compare American and Japanese amateurs to our disadvantage. Each has different goals and attitudes. The civilizations are vastly different. Japan may have no code requirement for entering amateur radio, but many Japanese amateurs are competent CW operators. I just don't believe our declining ranks results from the code requirement.

With that out of the way, what makes a prospective American

radio amateur stick with it, become a ham, and advance in rank? It's not the presence or absence of a requirement. It's the degree of personal drive inherent in the individual as well as how he latches onto the opportunities that come his way. As I see it, Wayne, if he is interested, he will keep at it until he makes the grade.

If Johnnie is let off from learning how to read, Johnnie is going to be let off from mathematics and a lot of other school requirements. From what I have seen of the Japanese civilization, Hiko and Toshio are not passed for non-achievement in school. Japanese education is strict and no-nonsense.

I learned Morse code in the Boy Scouts; my high school supported an excellent radio club. While a senior, I was permitted an operating hour daily in the club station as long as my grades were up. True, I had advantages, but I made use of them and passed my exams fair and square fifty years ago. Passed my Extra class thirty years ago.

Continue to agitate against the code requirement, Wayne, but I don't think it will stop the young in heart who have really caught the dream.

Paul L. Schmidt W9HD
Bloomfield IN

Paul, I agree with you. I don't think the code has much to do with our declining ranks. I think that if we can get the kids exposed to amateur radio rather than CB...or drugs...we'll get into clining ranks. The code is a loser as far as separating the wheat from the chaff. We need to get back to having this a technical hobby. If we insist on hams having an understanding of radio instead of merely having to pass a stupid code-skill test, a test which has flooded us with dregs from the pits...we might be able to look for some progress and have more pride in our hobby and hams. The cretins who are screwing up amateur radio are naturally repelled by 73, so I can write freely about them. You are right about education, too...there is much to be said for some of the no-nonsense Japanese approach as opposed to the Dr. Spock permissiveness which we have fallen into over the last twenty years. Every psychological survey shows that kids respond better to much stricter guidelines...and are happier. But that would force the average parent to look up from the television set now and then...so forget it. No, if we're going to get kids out of the mess they're in, we're going to have to trap them with the fun of amateur radio...the fun of talking with the world...the fun of building...the fun of learning ...of experimenting...of doing things few others can do. I feel this is a tremendous resource and should be used to change our country and give it back some pride. — Wayne.

CALL FOR PAPERS

Papers are invited for the 1982 Annual VHF Conference to be sponsored on October 23, 1982, by the Electrical Engineering department, Western Michigan University. Principal emphasis will be placed on engineering developments applied to radio communication, design, and construction on the frequencies of 30 to 1200 MHz. Papers on a wide range of subjects are solicited including, but not necessarily limited to, these:

- Antennas and transmission lines
- Applications of microprocessors
- Audio-frequency equipment used with VHF transmitters and receivers
- Emergency gear
- Grounding and shielding
- Keying, break-in, and control circuits
- Measurements and test equipment for VHF
- Mobile and portable equipment
- Modulation and mixing
- Narrowband voice modulation
- Noise reduction
- Phase-locked loop uses
- Picture transmission and reception
- Power supplies including switchers
- Production technology and model building
- Propagation
- Recent equipment/new apparatus
- RTTY
- Satellite and Moonbounce topics
- State-of-the-art semiconductors, ICs, and filters with applications
- Transceivers

One of the basic purposes of this Conference is to provide a maximum opportunity to present findings by those experimenting, designing, constructing, testing, and inquiring into problems and methods applicable to VHF radio. This is an opportunity for beginning or mature researchers to report their findings to their peers. We especially encourage the inexperienced inquirers to obtain some experience by presenting a paper at our VHF Conference.

Authors wishing to present papers should send a synopsis or abstract (typically one or two pages with diagrams) describing the paper to Dr. Glade Wilcox W9UHF, Chairman, VHF Conference, Department of Electrical Engineering, Western Michigan University, Kalamazoo MI 49008. Foreign authors are requested to have a US contact.

Deadline for submission of synopses is June 30, 1982. Speakers will be notified of acceptance by July 4, 1982. Reproducible copy for the printed proceedings should be mailed to the Chairman two weeks prior to the day of the Conference.

Glade Wilcox W9UHF
Kalamazoo MI

ELMER LIVES

After reading the November, 1981, issue, and noting the letters to the editor from Frank D. Windsor and Tom Taorimina, I felt that I could no longer be silent. I am an aspiring Novice who hopefully will have upgraded to General by the time you receive this.

I became interested in ham radio as a youngster, but did not have the time necessary to devote due to college, medical school, residency, and then early struggling years of practice. In November, 1981, I learned the code and began to study theory. I immediately ran into problems, and needed to discuss my problems with someone more knowledgeable than myself. One of my patients (N9ATB) overheard my predicament and offered his services. Within two weeks, he had guided me past all of the rough spots; frequently he allowed me to listen and observe at his home while he made QSOs. He administered my Novice examination for me in early January.

As I progressed and started to increase my code speed, several other hams became known to me. I also discovered that another physician in my community was a ham. KB9DD has spent many hours working with me and has even made practice QSO tapes for me so that I could become more proficient at code and be really ready for the General exam. His assistance has been invaluable to me.

Through people like this I have come to truly appreciate the amateur radio spirit. I am no babe-in-the-woods: I have heard the foul language on 20 and am aware of the other problems that Frank and Tom illustrate, but I am certainly not convinced that things are as bad as they say. Elmer is sure alive and well here. All of the hams I know are courteous, helpful, and represent their hobby as true gentlemen. It is my privilege to join their ranks. I only hope that someday I can provide as much help and encouragement to a potential licensee.

Gregory L. Darrow, M.D.
Janesville WI

CHEAP-SCAN!

I read your article by Jeff DeTray WB8BTH regarding memory scan for the TR-9000. I am the owner of one myself and, like Jeff, realized to top off a great rig surely Kenwood could have had a memory scan. Well, here's the bottom line: the TR-9000 does have a memory scan; they just haven't brought the function out to a control! I sympathize with Jeff. His memory scan cost him $39.95; mine cost the price of one silicon diode, two pieces of wire, and some thinking.

The TR-9000 is microprocessor-controlled. (At this point, get your TR-9000 manual out.) Find the circuit diagram of board X53-11G0-11. (If you don't have a manual, rip the lid off your rig and remove the front control section by removing 4 screws, 2 on each side — allowing the front section to be moved to see and work on the board behind it.) Note Q15, the microprocessor; now all you have to do is connect pin 13 (PE-1) through a silicon diode to pin 38 (PB-1). Obviously, you won't want the scanner running continually, so a switch is needed. As some of the switches on the TR-9000 are DPDT and only used as SPST, I used the unused side of the NB switch.

Trace PE-1 + PB-1 on the board 'til a suitable pick-off point is found. Then remove the front panel, remove the power/volume control, and you will see

on the circuit board where one side of the NB switch is not used.

The result is that when NB is out, the scanner is in and can be controlled by scan and hold buttons manually. And when a signal is present, it will stop until it ceases, and then continue. If mike P/T is operated, the scanner will stop and has to be restarted manually by pushing SCAN on your rig.

A simple addition to a fine rig.

R. M. Somann-Crawford VK7RC
Tasmania, Australia

FAR SCHOLARSHIPS

The Foundation for Amateur Radio, Inc. (FAR), a nonprofit organization with headquarters in Washington DC, plans to award nine scholarships for the academic year 1982-1983. The Foundation, composed of fifty local area amateur radio clubs, fully funds two of these scholarships from the proceeds of the Gaithersburg (MD) Hamfest. It administers, without cost to the donors, two scholarships for the Quarter Century Wireless Association and one each for the Richard G. Chichester Memorial, the Radio Club of America, the Young Ladies' Radio League, the Edmund B. Redington Memorial, and the Amateur Radio News Service. The last-named award is new this year.

Radio amateurs holding at least an FCC General class license or equivalent may compete for one or more of these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled or have been accepted for enrollment in an accredited university, college, or technical school. The scholarship awards range from $300 to $900, with preference given in some of them to residents of specific geographical areas or the pursuit of certain study programs.

Additional information and an application form can be requested by a letter or QSL/postcard postmarked prior to May 31, 1982, from me.

The Foundation is devoted exclusively to promoting the interests of amateur radio and to the scientific, literary, and educational pursuits that advance the purposes of the Amateur Radio Service.

Hugh A. Turnbull W3ABC
6903 Rhode Island Avenue
College Park MD 20740

WOODPECKER REFORMED?

Over the past several months, the amateur bands have experienced to a varying degree deliberate interference that has acquired the label "The Woodpecker."

I have read of efforts to have this interference eliminated, by political and non-political bodies. However, all efforts in the past have not been effective. Based on the old-time adage of "if you can't lick them. . .", perhaps we could take advantage of this activity.

There are various propagation indicators and forecasts to aid amateurs in their efforts to communicate. Why cannot the Woodpecker be used in the same manner? It should certainly provide band-opening information, at least in some direction.

I wonder, if worldwide attention were given to this activity on a scheduled basis, perhaps the instigators of this noise might feel they are contributing too much to the welfare of others. When WWV and others give the solar-flux index, they could also give the "Woodpecker: forecast for various frequencies and times." I'm sure this information is being kept somewhere; let's put the Woodpecker to good use!

Glenn A. Churchill KA2IOI
Hudson Falls NY

FCC SPELLING

This is in reference to the letter from Bill Crowley on page 121 of the February, 1982, issue of *73 Magazine*.

There are no incorrectly spelled words in any of the Morse code tapes which the FCC uses to test amateur radio operators. The word "Springfield" is contained in some of the tapes, and it is spelled correctly, not with a "C" as Mr. Crowley alleges.

After the publication of Mr. Crowley's letter, the cassettes used by the Boston office were double-checked to see if the tapes had somehow been garbled or partially erased. It was found that these tapes are in good condition.

I regret that Mr. Crowley felt it necessary to encourage others to complain about a situation which does not exist. The Commission continues to make every possible effort to ensure that the amateur radio examinations are unambiguous and straightforward.

Vernon P. Wilson
Chief, Regional Services Division
FCC
Washington DC

Now we have heard the FCC's side of the story. What has been your experience? — N8RK.

A MATTER OF CHOICE

Sorry, Wayne, but Jim Owens W5FQE's letter (January, 1982) hit the nail on the head. My wife renewed last year's subscription only because she got it mixed up with *QST*.

Mitch Armstrong W7CDM
Puyallup WA

This letter was forwarded to us by QST. *— Ed.*

ATLANTA SCHOLARSHIPS

The Atlanta Radio Club announces that three (3) cash $500.00 scholarships will be awarded to graduating high-school seniors who enter an accredited college or university in the fall of 1982. Recipients must be duly licensed amateur radio operators at the time of application.

This is the fourth consecutive year in which the Atlanta Radio Club has been able to award scholarships to deserving amateurs. The three scholarships to be awarded in 1982 represent an increase of one additional scholarship over past years.

For additional information and application forms, write to Phil Latta W4GTS, Secretary, Atlanta Radio Club Scholarship Committee, 259 Weatherstone Parkway, Marietta GA 30067.

Completed applications, along with the required high-school transcript, must be postmarked not later than July 1, 1982.

Morris Johnson KB4IT
Atlanta GA

FATHER OF SSB?

Jeanne Hammond's excellent article, "The Father of FM," in the February, 1982, issue does not mention single sideband. I believe Major Armstrong was the first to use this type of radio communication, and I mentioned this in my book, *Radio Stations Common? Not This Kind*. If anyone does not agree with this record, would they please provide the source of the detail on who they believe was first with sideband? Major Armstrong had so many firsts that we now take for granted that Jeanne probably did not mention this one because she was concentrating on his accomplishments with FM.

Spud Roscoe VE1BC
Sambro Head NS
Canada

EYEBALL TIME

July of this year marks the 25th reunion of the VHF radio amateurs who were members of the Oklahoma Central 6-Meter Club, later known as the Oklahoma Central VHF Club. All persons who were at any time members of this group are urged to write immediately to T. W. Stevens W5VCJ, PO Box 976, Edmond OK 73083. Give him your name, address, and present call and indicate whether you are interested in attending the reunion, which will be held at the same time as but not in conjunction with the Oklahoma City "Ham Holiday."

Carl C. Drumeller W5JJ
Warr Acres OK

HAM HELP

I need a schematic and manual for a Fluke 8120A digital multimeter. I will pay for copies or will copy and return originals. Thanks.

Geoff. Chadwick KA7MKN
Box 361
Red Lodge MT 59068

I will pay any reasonable price for a manual and schematic for the Model 680-0 Itron frequency counter, or I will copy and return your original.

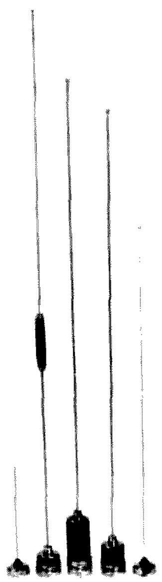
James Dickinson W4LLF
1408 Monmouth Ct. W.
Richmond VA 23233

NEW PRODUCTS

PROFESSIONAL-AMATEUR ANTENNA SERIES

Valor Enterprises has introduced the Pro-Am (Professional-Amateur) line of antennas, mounts, and accessories that are compatible with the Motorola TAD and TAE mounts, a system used extensively by the amateur and commercial communities.

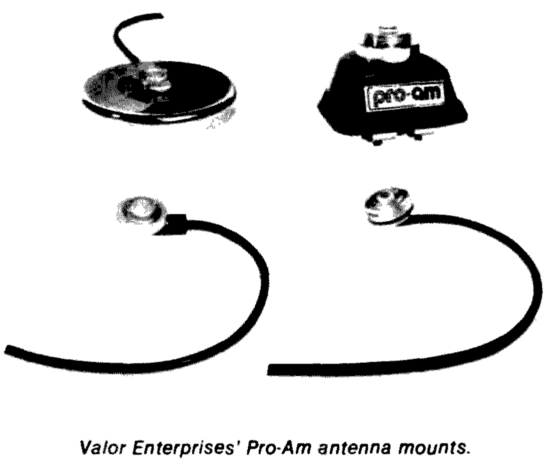
Four mounts are offered. The model PAS ($11.25) is a basic surface mount that installs in a ¾" hole (lower left in photo). Valor's model PAS38 ($11.25) basic surface mount installs in a ⅜" hole (lower right), while the model PAT ($14.85) is a no-hole trunk mount (upper right). The fourth mount, model PAM ($22.00), is a low-profile magnetic base (upper left).



Valor Enterprises' Pro-Am antennas.

The Pro-Am antennas are available in four categories. Left to right in photo: models PAQ ($5.95), of which there are twelve versions, act as ¼-wave whips for frequencies between 136 and 866 MHz; model PUB ($24.50), a 5-dB collinear series, available for 440-512 MHz; model PLB ($26.35), a ¼-wave, base-loaded antenna that can be selected to cover *any frequency* in the 27-to-54-MHz spectrum, and model PHB ($23.25), a ⅝-wave design that offers 3 dB of gain on the two-meter and 70-cm bands. (Another model PAQ is on the right.)

All models are engineered for demanding environments, featuring stainless-steel whips, nickle-chrome-brass parts, and "O"-ring seals. For more information, contact: *Valor Enterprises, 185 West Hamilton St., West Milton OH 45383.* Reader Service number 482.



Valor Enterprises' Pro-Am antenna mounts.

KENWOOD'S TS-930S HF TRANSCEIVER

Trio-Kenwood has announced the development of a top-of-the-line, all solid-state, high-frequency transceiver, the TS-930S. Designed to cover all amateur bands from 160 to 10 meters, the TS-930S also incorporates a 150-kHz-to-30-MHz general-coverage receiver which offers excellent dynamic range. Among the more interesting features to be found on this model are an automatic antenna tuner, dual digital vfos, eight memory channels, dual-mode noise blanker, i-f notch filter, fluorescent tube display, rf speech processor, rf step attenuator, and 100-kHz marker.

Kenwood's TS-930S HF transceiver.

Special circuitry allows the operator to adjust the i-f passband characteristics for rejection of interference and includes a tunable audio filter for CW reception. Power input is 250 W PEP SSB, 250 W dc on CW, 140 W dc on FSK, and 80 W dc on AM. The built-in power supply operates on 120, 220, or 240 V ac. Kenwood's newest HF transceiver will have a list price under $2000. For more details, write to *Trio-Kenwood Communications, PO Box 7065, Compton CA 90224.*

220-MHZ ALL-MODE AMPLIFIER

Mirage Communications Equipment, Inc., has announced the release of a new 220-MHz amplifier. The C106 amplifier is a solid-state, "all-mode" amplifier designed to be used in the 220-to-225-MHz amateur band. It will amplify a 10-Watt radio to more than 60 Watts output, or a 2-Watt radio to 25 Watts out. Since the C106 is biased as a linear amplifier, it can be keyed with as little as 300 milliwatts.

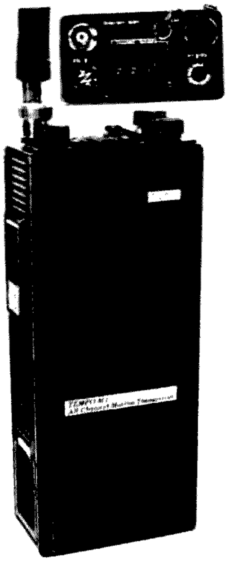
Other features include remote operation with the optional RC-1 remote head, and external or internal keying circuitry. The C106 lists for $199.95. For further information, contact *Mirage Communications Equipment, Inc., PO Box 1393, Gilroy CA 95020.* Reader Service number 490.

NO-RADIAL VERTICAL ANTENNA

Cushcraft has introduced the R3, a no-radial 10-, 15-, and 20-meter gain antenna. The R3 is perfect for limited-space applications like condominiums, apartments, mobile homes, and small urban lots. It is a ½-wavelength, endfed 22′ radiator with remote tuning for broadband coverage.

Installation is very simple, with only one square foot of space needed. It also can be telescoped for easy carrying and storage. Because of its unique design, the R3 does not need a tower, rotator, large support mast, or tuner. For more in-

Cushcraft's R3 no-radial vertical antenna.



Henry Radio's all-channel marine portable.

formation, contact *Cushcraft Corp., PO Box 4680, Manchester NH 03108.* Reader Service number 476.

ALL-CHANNEL MARINE PORTABLE

Henry Radio is introducing a marine VHF-band portable, the Tempo M1. The M1 operates on every marine channel, both US and international, with all the necessary offsets built in. It also includes all weather channels and a channel 16 override function. Channel selection is made by a thumbwheel switch on the top panel.

Other features include a one-hour, quick-charge-type battery, permanent memory, a high-power, 2½-Watt position, and a low-power, 1-Watt position. Accessories will include a charger, holster, amplifier, and high-capacity batteries.

The Tempo M1 is available through the Marine Division of Henry Radio. The suggested list price is $495.00. For more details, contact *Henry Radio, 2050 S. Bundy Dr., Los Angeles CA 90025; (215)-820-1234.* Reader Service number 480.

TELEREADER TERMINAL

The Hal Communications CWR-670 is a compact electronic communications terminal designed for reception of Baudot and ASCII radioteleprinter signals as well as Morse code signals. The CWR-670 includes built-in RTTY and Morse demodulators and video-generation circuits. The very small size of the CWR-670 makes it ideal for applications where space is limited.

The Hal CWR-670 Telereader terminal.

Since the terminal operates from 12 V dc, it may easily be used in locations where ac power is not readily available. The video-output screen of the CWR-670 is formatted in pages of 16 lines, 32 characters per line; a total of two page screens may be selected. The internal RTTY demodulator allows selection of three standard shifts. A parallel ASCII-printer output is also provided. The CWR-670 has a list price of $495.00. For more information, contact *Hal Communications, Box 365, Urbana IL 61801; (217)-367-7373.* Reader Service number 483.

REPEATER CONTROLLER

Advanced Computer Controls has introduced its new microcomputer-based RC-850 repeater controller. The controller's characteristics are remotely configured by the repeater owner with highly-secure tone commands. No hardware or software changes are required to modify control operator and user codes, ID and tail messages, Morse code speed, pitch and level, and a host of other functions.

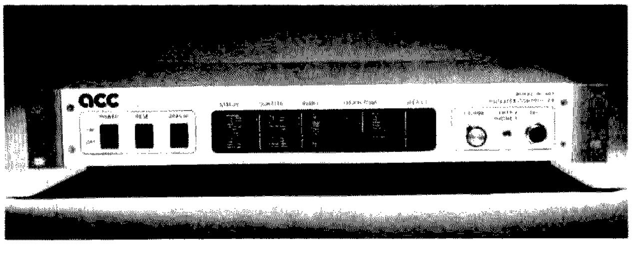
The RC-850 controller's autopatch is based on a store/forward technique where the user enters a phone number and the controller actually dials the phone using either touchtone™ or dial pulses. Logic outputs allow remote control of equipment at the repeater site. A voice-telemetry option adds a natural-sounding speech synthesizer with analog-measurement capability.

The controller uses CMOS logic and low-power, analog circuitry to minimize current consumption. The RC-850 is priced from $1850. For more information, contact *Advanced Computer Controls, 10816 Northridge Square, Cupertino CA 95014; (408)-253-8085.* Reader Service number 478.

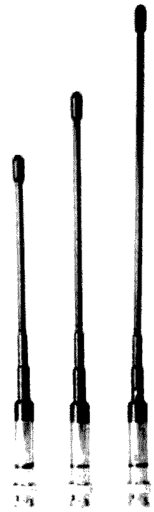
RTTY PROGRAM

The Egbert RTTY program transmits and receives RTTY without the need for any expensive interface hardware. The Apple cassette ports connect directly to the transmitter/receiver. Program capabilities include 60-, 67-, 75-, and 100-wpm Baudot and 110-baud ASCII, type-ahead buffer, canned messages, and automatic CW identification.

The program runs on the 48K Apple II and requires an Apple disk with DOS 3.2 or 3.3. The program and instruction manual cost $42.45 and are available from *W. H. Nail Co., 275 Lodgeview Dr., Oroville CA 95965.* Reader Service number 487.



The RC-850 repeater controller.



Centurion International's flexible antenna.

FLEXIBLE ANTENNA

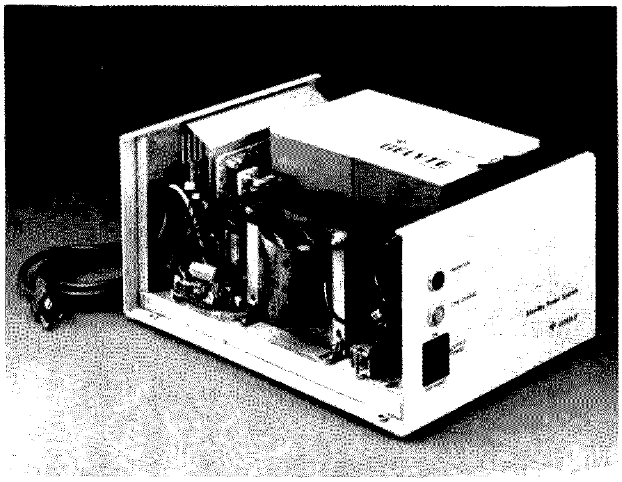
Centurion International has introduced a new flexible UHF gain antenna for use with handheld radios. The antenna features an endfed design and represents a ½-wave radiator with approximately 2.5 dB gain over a ¼-wave portable whip antenna.

The antenna is factory-tuned to discrete frequencies from 406 to 512 MHz and has a usable bandwidth of 20 MHz. The base is fitted with a BNC connector. Designated Style G, the new antenna ranges in length from 7 to 13 inches and lists for $17.50. For more information, write or call *Centurion International, PO Box 82846, Lincoln NE 68501; (402)-467-4491.* Reader Service number 484.

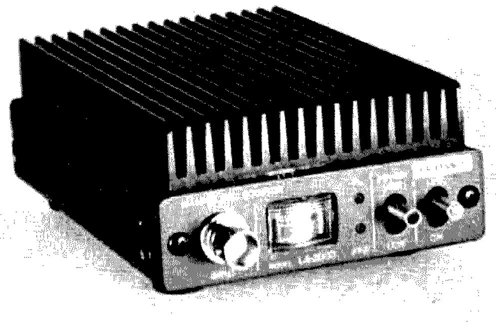
STANDBY POWER SYSTEM

The Portable Battery Division of Gould, Inc., has announced a Standby Power System (SPS) which provides 200 Watts of emergency power at 120 volts for 20 minutes, taking over the job of supplying power within one cycle of power failure.

As long as the power is constant into the SPS, the current passes through to the computer or other device being powered. However, if power drops below 102 volts, a sensing device immediately switches to an internal battery and turns on a red indicator light. If the power outage is brief, the device will automatically transfer back to line power and recharge the internal battery. Gould's standby power



The Gould standby power system.



Daiwa's booster amplifier.

system has a suggested price of $489.00. For more details, contact *Gould, Inc., Portable Battery Division, PO Box 43140, St. Paul MN 55164.* Reader Service number 486.

MORSEMATIC KEYER UPDATE

Advanced Electronic Applications, Inc., has announced the latest generation of the MorseMatic keyer, the MM-2. The MM-2 is a full-feature, paddle-input keyer that offers virtually all the features of the MM-1 predecessor plus CMOS memory and a new price. Like the MM-1, the MM-2 offers features that include an automatic serial-number generator, an automatic beacon mode, and an automatic speed-increasing Morse code trainer mode.

The MM-2 keyer comes in an rf-protecting metal package and is powered by 10 to 16 V dc. Independent + and − output keying allows connection to virtually any amateur transmitter. For further information on AEA's new $139.95 keyer, write *Advanced Electronic Applications, Inc., PO Box 2160, Lynwood WA 98036, or call (206)-775-7373.* Reader Service number 491.

COMPANDOR KIT

Advanced Analog Systems has announced a design evaluation kit for the Signetics NE572 dual-programmable compandor. The kit, designated AAS572, contains a printed circuit card, integrated circuits, and all components necessary to construct a complete audio compandor.

The system consists of two compressors and two expandors. Input to the compressor section consists of a high-performance, low-noise voltage follower. The system can be evaluated with either a single 2:1 compressor or by switching the ratio selector for 4:1 compression. There is also a choice between 1:2 and 1:4 expansion. Power requirements are plus and minus 15 V. The AAS572 costs $65.00 in single quantities. For more details, contact *Advanced Analog Systems, 790 Lucerne Dr., Sunnyvale CA 94086; (408)-730-9786.* Reader Service number 488.

BOOSTER AMPLIFIER

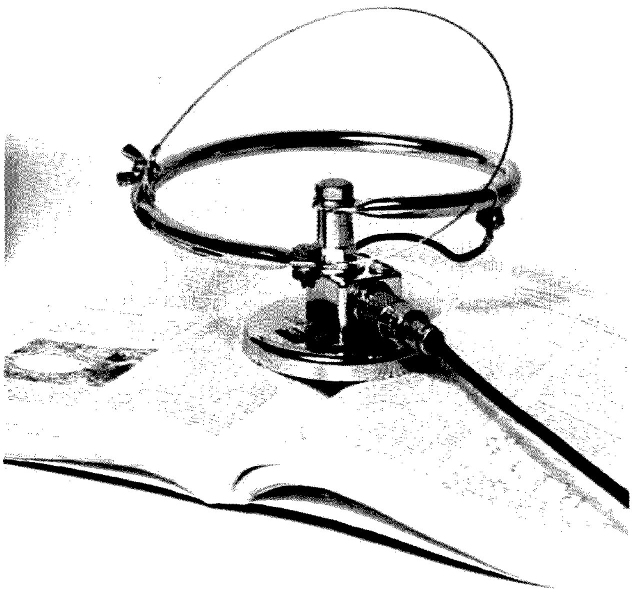
Daiwa announces a compact, lightweight amplifier, the LA2030, intended for the owners of two-meter, hand-held transceivers. It is available in three versions, depending on the power output of your transceiver. All versions can deliver a maximum of 15 or 30 Watts from 144 to 148 MHz.

The Daiwa LA2030 includes rf power metering and protection circuitry. The unit comes equipped with a BNC input and SO-239 output. Three feet of coax and BNC connectors are included in the $121.00 price. For more information, contact *MCM Communications, 858 E. Congress Park Dr., Centerville OH 45459; (513)-434-0031.* Reader Service number 481.

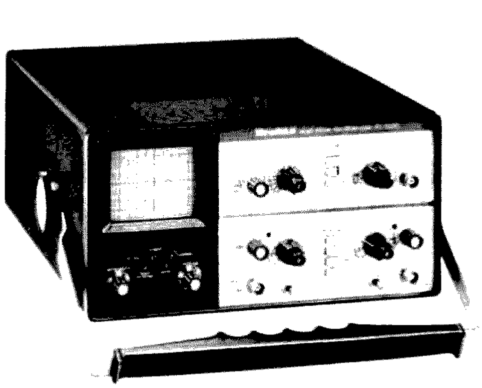
TWO-METER DDRR ANTENNA

High efficiency and small size are two key features of the Comrad Industries CR2A two-meter antenna. The CR2A is an adaptation of the Northrop Direction Discontinuity Ring Radiator (DDRR). Comrad's CR2A offers vertical polarization in a low-profile package suitable for either base or mobile use. Priced at $39.00, the CR2A is available from *Comrad Industries, 1635*

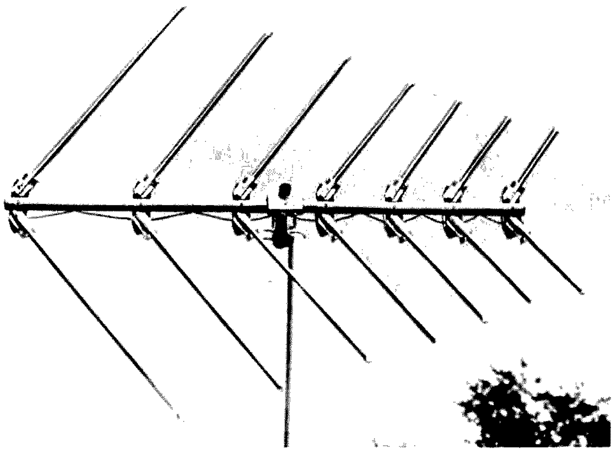
MorseMatic keyer update, the MM-2.



Comrad's two-meter DDRR antenna.



Heath's portable oscilloscope.



Low-power, wideband antenna.

West River Parkway, Grand Island NY 14072. Reader Service number 477.

SATELLITE TELEVISION RECEIVER

Arunta Engineering Company has introduced the DD 3000 stereo satellite television receiver. The DD 3000 can process multiplex, matrix, and discrete modes of stereo transmission in either wide- or narrow-deviation format.

Other significant innovations include a simplified installation requiring only an RG-59 cable between the receiver and remote downconverter, which transmits i-f, LNA power, and tuning voltage. With a suggested list price of $2995, the DD 3000 is available from *Arunta Engineering Co., PO Box 15082, Phoenix AZ 85060; (602)-956-7042.* Reader Service number 479.

PORTABLE OSCILLOSCOPE

Heath Company is introducing its first portable oscilloscope. The IO-3220 20-MHz oscilloscope can be used for most electronic measurement and comparison needs. It offers dual-trace capability, X-Y inputs, and a special algebraic add function. The IO-3220's sensitivity allows it to measure vertical signals as low as two millivolts. The scope's accuracy is rated within ± three percent on both horizontal and vertical measurements.

The IO-3220 oscilloscope is sold in kit form for $689.95. A factory-assembled version, the SO-3220, sells for $995.00. For more information on this portable oscilloscope, contact *Heath Company, Dept. 350-455, Benton Harbor MI 49022.* Reader Service number 489.

LOW-POWER WIDEBAND ANTENNA

Grove Enterprises has announced that their scanner beam antenna, the **ANT-1**, works for low-power transmitting as well as receiving. The beam works on 144-148 MHz, 220-225 MHz, and 420-450 MHz. The average vswr is 1.6:1. Because of its highly directional design, forward signal radiation is "targeted" towards distant repeaters or base stations, increasing the range of low-power transceivers.

For more information about the **ANT-1**, priced at $49.95, contact *Grove Enterprises, Dept. C, Brasstown NC 28902; (800)-438-8155.* Reader Service number 485.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Last month I described what may be the ultimate in RTTY output devices: a synthesized voice. Using the new Votrax Type 'N Talk, a self-contained speech synthesizer, and a 6800 computer, this setup allows conventional RTTY to be presented to the operator not as text on a page or view screen, but as an easily understandable computerized voice, capable of pronouncing whatever is sent. This month, let's look at the programming.

The program is written for my 6800 system, which, in its current state of evolution, uses the GIMIX GMXBUG version 3.0 monitor, the GIMIX VDM, and a Smoke Signal disk system, running under DOS68 version 6.1. Along with the video board, assigned to port #4 in the GIMIX system, GMXBUG supports a printer or other output device on either port #3 (serial) or port #4 (parallel). Output vectors are provided to direct data to the VDM, printer, or both. By connecting the Type 'N Talk to port #3, as a serial device running at 1200 baud, we can take advantage of this capability in the demonstration program. Lacking this feature, as in a system using another monitor, separate video and speech output routines could be used with minimal rewriting.

The program itself follows the flowchart presented last month fairly closely. Beginning at $0100, the first chores taken care of are housekeeping: clearing the screen, setting the GIMIX-software-controlled bell to a high pitch and short duration, and initializing the PIA for input. The output vector is also set so that both the screen and voice are initially active.

The actual receiving loop is next down the line. The keyboard is checked for input first. If there is no data found (we will cover what happens when there is input in a little bit), the PIA is checked. The RTTY input is fed to the least significant bit of the "B" side (B0) of a PIA located in port #5. If a START pulse is not found, then a loop back to the keyboard check is executed. By the way, since we are interfacing via an RS-232-type line to the demodulator, recall that the START, which is sent as a "0" level (or space), is represented by a positive voltage. Thus, reading a "1" on the B0 line translates to a space; a "0" is mark, the resting condition.

Once a START pulse is found, a counter is set up and five data pulses are read in. The step-by-step process is covered in the remarks in the program source listing. After screening for case shifts, spaces (which initiate a downshift-on-space), and carriage returns, otherwise unremarkable letters are decoded in a simple indexed table lookup.

The ASCII character, once retrieved from the table, is output by way of the GIMIX OUTCHR routine. As stated above, this routine will vector to either the screen only, the printer (voice) only, or both. However, I only provide the facility within this program to select screen only or screen and voice.

Now, let's get back to keyboard input. I wanted to provide a way to give commands without worrying over accidentally hitting a key and messing something up. So, in the best tradition of secure devices, only one key is recognized while receiving: the ESCAPE key. Hitting any other key is ignored. Striking the ESC key results in two effects. A flag, called the Command Flag (CMDFLG) is set to "1". This indicates that an ESC has been

hit, and that the next keyboard input should be examined as a command character. Then the local bell is rung, to verify receipt of the ESC.

Once the Command Flag has been set, several commands will be recognized by the system. A look at them reveals: V = voice *on*; S = silent—voice *off*; C = caps mode *on*; D = caps mode *off*.

The voice on and off commands are handled by storing a $01 or $00 in the output vector, respectively. The CAPS mode of operation was touched on last month, but deserves another word now. In the conventional mode, CAPS off, words are pronounced as they are spelled. However, groups of letters which are unpronounceable are still attempted, no matter how mangled the effort. Thus, a typical RTTY sign off, such as "N3BRD DE WA3AJR BCNU KKKK," is pronounced. . .well you get the picture if you try it yourself. To get around this problem, a CAPS mode is available, in which groups of capital letters will be spelled out one by one. This is exactly what we need in a RTTY program, and the "C" and "D" commands allow you to turn this mode on or off as needed.

One other command is recognized, by the way. Sending a second ESC will terminate the program and return to DOS. Just provides a clean getaway, if you follow me. Sending any other character will clear the CMDFLG and send nothing out to the Type 'N Talk or VDM.

Granted, this demonstration program is just that, a demonstration. But I feel it shows the kernel of a system that would be useful to many hams — especially visually-handicapped ones.

One feature of this column that many of you have expressed a particular fondness for is the range of material covered. I don't want to disappoint you, so let's go from high tech to basics. Bob Henry, a Boston MA reader, dropped me a line with two good questions. He begins by asking what a "cursor" is for. For the uninitiated, the cursor is the little box, blinking or solid, or sometimes an underline, that scoots along on a video screen just ahead of where you last typed. Why? Try to imagine a typewriter, Bob, where the whole page was somehow suspended in front of you. When you hit the keyboard the characters are placed on the page in order, but that little plastic thingy that normally sits dead center, and through a hole in the center of which the typebar hits the paper, is missing. How do you know where you are? Where to space? If a new line has started? With a typewriter all that information is provided by that guide and the position of the carriage. With a video screen, there ain't no such guide. That is what the cursor is for!

Bob's other question involves an item touched upon above: unshift-on-space. Recall that on RTTY, using five-level Murray code, two cases — letters and figures — are available. Now, if you miss a "LTRS" or "FIGS" code, the proper case will not be selected, and gibberish will result. On ham RTTY, numeral groups are rarely sent. The odds are that if a space is sent, what follows is in the letters case. Let me illustrate. If I send "DE WA3AJR IN MARYLAND," recall that the "3" is preceded by a FIGS and followed by a LTRS. If that LTRS is missed, what prints out is "DE WA3-'4 8, .-46)-,$", all after the 3 being in figures case. With downshift on space, the first space forces letters case, and "DE WA3-'4 IN MARYLAND" results. Less is missed.

Program listing.

```
                     NAM   SPEAK.TTY
                     OPT   NOG,NOG

               ******************************
               *    DEMONSTRATION PROGRAM   *
               *             TO             *
               * OUTPUT RTTY  AS SPEECH ON  *
               *  THE VOTRAX TYPE 'N TALK   *
               *                            *
               * FOR MAY, 1982 "RTTY LOOP"  *
               *  by MARC I. LEAVEY, M.D.   *
               ******************************

               *<>* EXTERNAL REFERENCES *<>*
001B           ESC    EQU   $1B
8014           PIA    EQU   $8014
3F11           OUTCHR EQU   $3F11
3F16           PCRLF  EQU   $3F16
3F17           PFFEED EQU   $3F17
3F26           INKEY  EQU   $3F26
3F27           PRINT  EQU   $3F27
A036           OUTPTR EQU   $A036
A037           NULCNT EQU   $A037
A03E           PRFLAG EQU   $A03E
A03F           DURATN EQU   $A03F
A041           PERIOD EQU   $A041
D283           ZWARMS EQU   $D283
               *<>* MURRAY/ASCII TABLE *<>*
0000                  ORG   $0
0000 7F        LTRTBL FCB   $7F
0001 4B               FCC   \KQU\
0004 00               FCB   0
0005 4A               FCC   \JWAXFYSBDZEVCPIGRL\
0017 00               FCB   0
0018 4D               FCC   \MNH\
001B 20               FCB   $20
001C 4F               FCC   \O\
001D 00               FCB   0
001E 54               FCC   \T\
001F 00               FCB   0
0020 7F        FIGTBL FCB   $7F
0021 28               FCC   \(17\
0024 00               FCB   0
0025 27               FCC   \'2-/!6\
002B 07               FCB   7
002C 3F               FCC   \?4"3;:08&4)\
0037 00               FCB   0
0038 2E               FCC   \.,# 9\
003D 00               FCB   0
003E 35               FCC   \5\
003F 00               FCB   0
               * STORAGE AND STRINGS
0040 00 00     TABLE  FDB   0
0042 08 00     RCVDLY FDB   $800        60 WPM (45.45 BAUD)
0044 00        CMDFLG FCB   0
               *< MAIN PROGRAM STARTS HERE >*
0100                  ORG   $100
0100 3F 17     START  FDB   PFFEED      Clear video screen
0102 CE 2000          LDX   #$2000      Set BINIX "bell" for short
0105 FF A03F          STX   DURATN      duration and a
0108 86 10            LDA A #$10        high pitched
010A B7 A041          STA A PERIOD      tone...
010D 86 FF            LDA A #$FF
010F B7 A03E          STA A PRFLAG      Set up for serial printer
0112 7F A037          CLR   NULCNT      Output no nulls
0115 86 01            LDA A #$01        Set output for both
0117 B7 A036          STA A OUTPTR      Screen and "Printer" (Voice)
011A 4F        PIAINT CLR A             Initialize input PIA
011B CE 8014          LDX   #PIA
011E A7 02            STA A 2,X
0120 A7 03            STA A 3,X
0122 86 04            LDA A #$4
0124 A7 03            STA A 3,X
               *
               * RECEIVING ROUTINE
               *
0126 3F 26     RCVING FDB   INKEY
0128 27 49            BEQ   STBAUD
012A 7D 0044   COMAND TST   CMDFLG      Has an ESC been sent?
012D 26 0D            BNE   ESCSNT      Yes, try to process command
012F 81 1B            CMP A #ESC        No, is this an ESC?
0131 26 40            BNE   STBAUD      No, forget it!
0133 7C 0044          INC   CMDFLG      Yes, set the Command Flag
0136 86 07            LDA A #$07        Ring the local bell to
0138 3F 11            FDB   OUTCHR      confirm ESC receipt.
013A 20 37            BRA   STBAUD      ... and continue monitoring
013C 7F 0044   ESCSNT CLR   CMDFLG      Clear the Command Flag
013F 81 1B            CMP A #ESC        Is input another ESC?
0141 26 03            BNE   NOTESC      No...
0143 7E D283          JMP   ZWARMS      Yes, get out of here!!
0146 81 43     NOTESC CMP A #'C         C = CAPS ON
0148 26 04            BNE   NOTAC
014A 86 15            LDA A #$15        TNT Code for CAPS ON
014C 20 1D            BRA   PNTESC      Send code to TNT
014E 81 44     NOTAC  CMP A #'D         D = CAPS OFF
0150 26 04            BNE   NOTAD
0152 86 16            LDA A #$16        TNT Code for CAPS OFF
0154 20 15            BRA   PNTESC
0156 81 56     NOTAD  CMP A #'V         V = Voice ON
0158 26 07            BNE   NOTAV
015A 86 01            LDA A #$01
015C B7 A036          STA A OUTPTR      Vector to Screen and "Printer"
015F 20 12            BRA   STBAUD
0161 81 53     NOTAV  CMP A #'S         S = Voice OFF (Silent)
0163 26 0E            BNE   STBAUD      Whoops! Forget it fellows...
0165 4F               CLR A
0166 B7 A036          STA A OUTPTR      Vector to Screen only
0169 20 08            BRA   STBAUD
016B 36        PNTESC PSH A             Send ESC seq to TNT - save A
016C 86 1B            LDA A #ESC        Load it with an ESCAPE
016E 3F 27            FDB   PRINT       Send that out
0170 32               PUL A             Retrieve code to send
0171 3F 27            FDB   PRINT       ... and send that out
0173 CE 8014   STBAUD LDX   #PIA        Now check for TTY input
0176 A6 02            LDA A 2,X         Look for a START pulse
0178 4D               TST A
0179 27 AB            BEQ   RCVING      Not there yet, keep looping
017B 8D 43            BSR   RMS10       Found one, delay 1/2 pulse
017D C6 05            LDA B #$5         Set up five bit counter
017F 4F               CLR A             Clear the A accumulator
0180 48        CHLOOP ASL A             Shift the A accumulator one left
0181 8D 3A            BSR   RMS20       Wait one pulse length
0183 CE 8014          LDX   #PIA        Pick up pulse in progress
0186 AA 02            ORA A 2,X         Stuff it into character in formation
0188 5A               DEC B             Decrement the counter
0189 5D               TST B             Are we done?
018A 26 F4            BNE   CHLOOP      No... do it again
018C 8D 2F            BSR   RMS20       Yes, wait until last pulse is over
018E 81 1D            CMP A #$1D        Is this a CAR RET?
0190 26 04            BNE   ISFIGS      No, do next check
0192 3F 16            FDB   PCRLF       Yes, output CR/LF pair
0194 20 90            BRA   RCVING      ... and wait for next character
0196 81 04     ISFIGS CMP A #$04        Is this a FIGS?
0198 27 0F            BEQ   FIGS        Yes, go to FIGS routine
019A 81 00            CMP A #$00        Is this a LTRS?
019C 27 04            BEQ   LTRS        Yes, go to LTRS routine
019E 81 1B            CMP A #$1B        Is this a SPACE?
01A0 26 0F            BNE   GETCHR      No, process character normally
01A2 CE 0000   LTRS   LDX   #LTRTBL     Choose LTRS table
01A5 DF 40            STX   TABLE       Store it as active table
01A7 20 08            BRA   GETCHR      Process character, if any
01A9 CE 0020   FIGS   LDX   #FIGTBL     Choose FIGS table
01AC DF 40            STX   TABLE       Store it as active table
01AE 7E 0126          JMP   RCVING      Look for next character
01B1 B7 01B7   GETCHR STA A LOCATE+1    Store Murray code as offset
01B4 DE 40            LDX   TABLE       Pick up current table
01B6 A6 00     LOCATE LDA A X           Load A with ASCII value
01B8 3F 11            FDB   OUTCHR      Put out through BINIX routine
01BA 7E 0126          JMP   RCVING      Loop for next character
               *
01BD 8D 01     RMS20  BSR   RMS10       Two 10s = One 20!
01BF 01               NOP
01C0 DE 42     RMS10  LDX   RCVDLY      Pick up delay factor
01C2 09        RMLOOP DEX               Decrement it
01C3 26 FB            BNE   RMLOOP      Loop 'til done...
01C5 39               RTS               ... then exit
               *
0100                  END   START
     NO ERROR(S) DETECTED
```

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

COUNTY HUNTERS SSB CONTEST
Contest Periods:
0001 to 0800 GMT May 1
1200 GMT May 1 to 0600 May 2
1200 to 2400 GMT May 2

Please note the two 4-hour rest periods. Mobiles may be worked each time they change counties or bands. Mobiles that are worked again from the same country on a different band count for point credit only. Mobiles that are contacted on a county line count as one contact but 2 multipliers. Fixed stations may be worked by other fixed stations only once during the contest. Repeat QSOs between fixed stations on other bands are not permitted. Fixed stations may be worked by mobiles each time they change counties or bands. Repeat contacts between mobiles are permitted provided they are on a different band or county. Mixed-mode contacts are permitted provided that one station is on SSB. Contacts made on net frequencies will not be allowed for scoring in this year's contest.

EXCHANGE:

Signal report, county, and state or country.

FREQUENCIES:

Suggested frequencies are as follows: 3920-3940, 7220-7240, 14275-14295, 21375-21395, 28625-28650. There will be a "mobile window" of 10 kHz on the following frequencies: 3925-3935, 7225-7235, 14280-14290. Mobiles will be in this 10-kHz segment and fixed stations are asked to refrain from calling "CQ contest" in the mobile window. After working mobiles in the "window," fixed stations are requested to QSY outside the "window" to work fixed stations in the contest. This will allow the mobiles running lower power a chance to be heard and worked in the contest. There will be a special effort to work DX on 28.636 by mobiles.

SCORING:

Contact with a fixed US or Canadian station = 1 point; contact with a DX station (KL7 and KH6 count as DX) = 5 points; contact with a mobile station = 15 points. The multiplier is the total number of US counties plus Canadian stations worked. The final score is this multiplier times the total QSO points.

AWARDS:

MARAC plaques to the highest scoring fixed US or Canadian station, DX station, and top 2 scoring mobile stations. Certificates to the top 10 fixed and mobile stations in the US and Canada, and to the highest scoring station in each DX country.

ENTRIES:

Logs must show date and time, station worked, reports exchanged, county, state, band, claimed QSO points (1, 5, or 15), and each new multiplier must be numbered. Logs and summary sheets are free for a #10 SASE or SAE and appropriate IRCs. Write John Ferguson WØQWS, 3820 Stonewall Ct., Independence MO 64055. All entries must be received by June 15th to be eligible for awards. DX entries should use air mail. Winners will be announced at the 1982 Independent County Hunters Convention during July and in the MARAC newsletter.

CALENDAR

May 1-2	County Hunters SSB Contest
May 15-17	Michigan QSO Party
May 22-23	Mt. Saint Helens QSO Party
Jun 5	Jefferson Davis QSO Party
Jun 12-13	ARRL VHF QSO Party
Jun 12-13	Worldwide South America CW Contest
Jun 18-20	Summer SMIRK Party
Jun 20-21	*A5 Magazine* Worldwide SSTV DX Contest
Jun 26-27	ARRL Field Day
Jul 10-11	IARU Radiosport
Jul 17-18	International QRP Contest
Aug 7-8	ARRL UHF Contest
Aug 7-8	*A5 Magazine* F5TV UHF Contest
Aug 14-15	European DX Contest—CW
Sep 11-12	ARRL VHF QSO Party
Sep 11-12	European DX Contest—Phone
Oct 16-17	ARCI QRP CW QSO Party
Nov 6-7	ARRL Sweepstakes—CW
Nov 13-14	European DX Contest—RTTY
Nov 20-21	ARRL Sweepstakes—Phone
Dec 4-5	ARRL 160-Meter Contest
Dec 11-12	ARRL 10-Meter Contest

SEVILLE WORLDWIDE CONTEST
Starts: 1600 UTC May 1
Ends: 2000 UTC May 2

This contest is sponsored by the Seville (Spain) City Council and organized by the Seville Radio Club. Only single-operator entries are eligible. You may operate 24 hours of the 28-hour contest period, with 4 hours of rest taken in one or two periods. Contacts are allowed on SSB and CW, but a station may be worked only once per frequency band.

BANDS:

80 through 10 meters.

EXCHANGE:

RS(T) plus QSO number beginning with 001.

MULTIPLIER:

DXCC countries worked on each band.

POINTS:

Contacts between stations in the same country count 2 points. Contacts between stations in different countries count 3 points. Exception: Contacts between EA, EA6, EA8 and EA9 count only 2 points.

SCORING:

Total QSO points times sum of multiplier points.

AWARDS:

Certificates will be awarded to the top-scoring station in each continent, each country, and each W/K, VE, JA, and EA call area. The Seville City Council will award an all-expense paid trip to Seville's April Fair Feast to the top-scoring EA and non-EA stations.

ENTRIES:

All times must be in UTC. Indicate multipliers in your log the first time they are worked on each band. Make a separate log and dupe sheet for each band. Include a summary sheet containing scoring information for each band, a station description, and a signed declaration that you have observed the contest rules and the regulations for amateur radio in your country. Please include your comments and photographs.

Entries must be postmarked no later than June 30th. Send entries to: Seville Worldwide Contest, Radio Club Sevilla, PO Box 555, Sevilla, Spain.

DISQUALIFICATION:

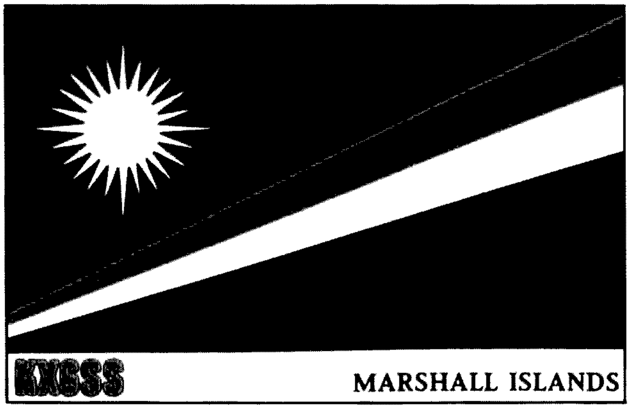
Violation of the contest rules, violation of amateur radio regulations, unsportsmanlike conduct, excessive duplicate contacts, or unverified QSOs will be deemed sufficient cause for disqualification. Decisions of the Contest Committee are final.

MICHIGAN QSO PARTY
Contest Periods:
1800 GMT Saturday, May 15 to 0300 GMT Sunday, May 16
1100 GMT Sunday, May 16 to 0200 GMT Monday, May 17

This year's QSO party will be sponsored by the Oak Park ARC. Phone and CW are combined into one contest. Michigan stations can work Michigan counties for multipliers. A station may be contacted once on each band/mode. Portable mobiles may be counted as new contacts each time they change counties.

EXCHANGE:

RS(T), QSO number, QTH as



QSL OF THE MONTH: KX6SS

The colorful flag of the Marshall Islands provides an attractive design for the QSL of Keith R. Merrick KX6SS. Keith also holds callsigns KG6SS and WA1GYS.

To enter our QSL of the Month Contest, put your card *in an envelope* and mail it, along with your choice of any book from *73*'s Radio Bookshop, to *73 Magazine*, Pine Street, Peterborough NH 03458, Attention: QSL of the Month. Entries which are not sent in an envelope (the Postal Service does *occasionally* damage cards) and do not specify a book will not be considered.

state, country, or Michigan county.

FREQUENCIES:

Phone—1815, 3905, 7280, 14280, 21380, 28580.

CW—1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125.

VHF—50.125, 145.025.

SCORING:

Multipliers are counted only once. Michigan stations score 1 point per phone QSO and multiply by the total number of states, countries, and Michigan counties. Each CW contact counts 2 points; KL7 and KH6 count as states; VE counts as a country. Maximum multiplier is 85.

Others take QSO points times the total number of Michigan counties. QSO points are 1 point per phone QSO and 2 points per CW QSO. Maximum multiplier is 83.

All stations score 5 points for each club station contact with W8MB.

VHF-only entries: same as above except multipliers per VHF band are added together for total multiplier. Score 5 points for each OSCAR QSO. No repeater contacts are allowed.

AWARDS:

Michigan trophies to high Michigan score, high Michigan (Upper Peninsula) score, high aggregate club score. Plaque to high VHF-only entry and high mobile. Certificates to high score in each county with a minimum of 30 QSOs. Out-of-state high trophy and certificates for high score in each state and country. Added this year is a trophy for the highest scoring Michigan multi-operator score.

ENTRIES:

A summary sheet is requested showing the scoring and other pertinent information, name and address in block letters, and a signed declaration that all rules and regulations have been observed. Michigan stations include club name for combined club score. Party contacts do not count toward the Michigan Achievement Award unless one fact about Michigan is communicated. Members of the Michigan Week QSO Party Committee are not eligible for individual awards. Decisions of the Contest Committee are final. Results will be final on July 31st and will be mailed to all entries. Mailing deadline is June 30th to: Mark Shaw K8ED, 3810 Woodman, Troy MI 48084.

MICHIGAN ACHIEVEMENT AWARD

This will be the 24th year that hams have had their own program to publicize Michigan and its products. Just as for past years, the Governor will award Achievement Certificates to hams who take part in telling the world of Michigan's unlimited resources, opportunities, and advantages. Certificates are awarded on the following basis:

1. A Michigan ham submits log information and names and addresses (if possible) of 15 or more contacts made to out-of-state or DX hams with information regarding Michigan.

2. An out-of-state ham, including Canada, submits log information and names and addresses (if possible) of at least five Michigan hams who relate facts to him about Michigan.

3. A foreign ham, excluding any resident of Canada, submits the call letters and name and address plus log information for at least one Michigan ham who has told him about Michigan.

Only QSOs made during Michigan Week, May 15-22, will be considered valid. All applications for certificates must be postmarked by July 1st and mailed to Governor William Milliken, Lansing MI 48902.

MT. SAINT HELENS QSO PARTY
Starts: 0001 GMT, May 22
Ends: 2359 GMT, May 23

The Clark County Amateur Radio Club, W7AIA, is pleased to announce the second annual QSO party marking the second anniversary of the cataclysmic explosion of nearby Mt. Saint Helens. This disastrous volcanic eruption took the life of Reid Blackburn KA7AMF, who was an active member of their club. Reid was monitoring a USGS observation station near the base of the mountain at the time of the eruption.

Any amateur station making one contact with W7AIA during the two days of the QSO party will be eligible to apply for the Mt. Saint Helens Award, a color certificate featuring a photograph of the awesome eruption of the volcano on May 18, 1980.

Look for W7AIA on the following frequencies (plus or minus QRM): SSB—3895, 7230, 14280, 21360, 28505; CW—3705, 7105, 21105, 28105; VHF—various Vancouver and Portland area repeaters.

To apply for the award, send log information or QSL card and $2.00 (or 8 IRCs) to: Award Manager, W7AIA, PO Box 1424, Vancouver WA 98668. All proceeds from the award will go to the Reid Blackburn Scholarship Fund which has been established by the *Columbian*, a Vancouver newspaper. So far, 647 amateurs have applied for the award, which has provided for a $1,000 contribution to the scholarship fund.

Kansas Amateur Radio

Public service in local and worldwide communications

NEWSLETTER OF THE MONTH

Amateur radio publications don't have to be either strictly local or strictly national in scope. This month's winner, *Kansas Amateur Radio*, is a good example of a regional publication.

Editor (and owner) KC0GL publishes *K.A.R.* quarterly in a magazine format. The January issue is printed on glossy stock and is 24 pages long. The layout is neat and the graphics are good; it's a professional-appearing publication. *Kansas Amateur Radio* covers what its name implies: the whole range of ham radio activities in Kansas, including net and club news, information about Kansas hams, and occasional technical articles.

This unique magazine is funded by reader contributions and a small amount of advertising revenue. It's a strictly non-profit operation that relies almost totally on reader support, both financial and editorial — as KC0GL puts it, "if you write it, we will print it!"

A lot of small clubs don't have enough going on to warrant a full newsletter each month. Support of a publication like *Kansas Amateur Radio* may be a more practical way for some clubs to get their news into print than undertaking the effort required to put out a good club newsletter. A group of clubs might even consider banding together to produce a cooperative newsletter. There's strength in numbers.

REVIEW

ICOM'S IC-720A TRANSCEIVER

Although the four buildings at *73 Magazine* are each more than a mile apart, no telephone is needed when new equipment arrives for review. The *73* hams start forming lines the minute word gets around that equipment has arrived. Responding to that call, I was informed that the senior staff was so pleased with my previous reviews of dummy loads, power supplies, and BNC-to-garden-hose adaptors that they were going to give me a shot at a real radio.

Real radio is an understatement when it comes to Icom's newest all-mode, general-coverage transceiver, the 720A. This state-of-the-art solid-state rig should fill the bill for just about all devotees of the various modes of amateur communications available to us today on the HF bands. The first two days that the rig was available to me, it was put to use at W2NSD/1 where it was compared to several other transceivers in the station at the same time. In typical Icom fashion, the 720A's receiver outperformed all others — no mean feat when you consider that the Icom has a general-coverage receiver covering 100 kHz to 30 MHz.

The 720A arrived at my station the evening that the ARRL 10-meter contest started and I thought that I would attempt to put the rig through its paces during part of the contest. As it came from the box, 15 minutes prior to the start of the contest, those familiar words "some assembly required" echoed in my mind. The separate power supply (IC-PS15) attached to the 720A with no problem. Two of the phono jacks, on the rear panel, serve dual functions. As it comes from the box, these jacks are set up to provide an input for a low-band antenna and transverter/scope output. If you wish to use a linear amplifier, you must change the position of an internal connector, converting the function of these jacks to provide ALC and relay outputs. The conversion of these jacks required a few minutes study of the manual and less time in effecting the change.

With a few minutes left before the start of the contest, I thought I would take a look at the general-coverage frequencies. At that time of night, reception was good on the lower bands. I was surprised at the fidelity of the AM reception with only the standard filter in place.

My first encounter was with a Colombian station on 5 MHz playing traditional music. Having lived in Colombia for several years, it brought back memories and made me an instant SWL nut. Other treats in the first tour around the bands were an Austrian Christmas music special, a Spanish-language discussion of solar flux, a British Broadcasting Company London *Times* news program, a Portuguese discussion of the economic situation in the United States, and, of course, the old standby, Radio Moscow, with an editorial on the United States' deployment of the neutron bomb in Europe. No tour would have been complete without a stop on the low end of 8 MHz where the CW maritime traffic, with its near-perfect code, is a great place to increase or maintain your code speed.

Icom's IC-720A transceiver alongside the PS-15 12-volt power supply.

An interesting feature of the 720A was noted during this tour. While listening to one of the AM broadcasts, I noted that our old friend, the Russian woodpecker, was as prominent here as he is on the ham bands. Out of curiosity, I turned on the noise blanker and watched the interfering signal fall from 20 dB over S9 to S3. I still knew the offending signal was there, but it was much less bothersome.

Looking up at the clock, I found that the contest was already four hours old (later diagnosed as SWLer's disease). I decided to get a good night's rest and tackle the pileups in the morning. At first light I was on the bands. My first contact was W2NSD/1, 5-9 New Hampshire. Not bad, but I decided to use my limited time to hunt for countries. In eight hours, I racked up 47 countries and got a feel for how the 720A performed.

Operator's Manual

The first thing that impresses the new owner of a 720A is the clarity of the operator's manual. It begins with a concise walk-through of all controls and external connections (more than 50). It next provides detailed explanations of the major controls. A description of the circuit operation follows, remarkably understandable for a rig of this complexity. The section on maintenance and adjustments, along with photographs, covers most problems that might be encountered. While the schematic is small, a large-scale parts layout, in four colors, will prove invaluable for repairs.

My concern for the understandability of the owner's manual is sparked by the fact that I am a rural ham, living more than seventy miles from the nearest ham store and doing most repairs at home. With the 720A's manual, I would have no qualms about undertaking most repairs in the shack.

Icom Pioneers Again

The radio itself is small, measuring 4" × 9" × 12" and engineered to maximize the use of space. It appears to be most functional when placed at eye level. With the 720A, Icom introduces a pioneering method of function and mode selection, similar to the system used by many pocket calculators. Pushbuttons replace many of the knobs used by old-fashioned rigs. Several of the controls are dual-function. While first impressions yield the feeling that you will never understand all of the controls, a few hours of use will convince you of the functionality of this method as you quickly jump from band to band, change modes, and select filters with this new system.

The receiver, unquestionably the hottest I have ever used, utilizes low-noise FETs in the rf amplifier to aid sensitivity and double conversion, with high side injection and steep-skirted filters for maximum selectivity. The receiver covers 0.1 to 30 MHz in 1-MHz steps. A two-position button allows you to step through the covered frequencies, stopping at ham bands only or at any 1-MHz segment. The operating frequency is determined by a microprocessor-controlled PLL. One of the most interesting features of this radio is a low-pass filter unit which employs a motor-driven rotary relay-switching circuit that selects various filter components for each band. During receive, the low-pass unit offers a high degree of adjacent channel rejection; during transmit, it removes harmonic components. The relay also delivers different control voltages to a plug on the rear panel for each band, thus allowing automatic band change for a linear amplifier and automatic antenna selection with external relays.

Operating Controls

The number of controls offered by the 720A provides maximum flexibility but makes description of the actual ease of operation difficult. In order that my written description does justice to the user-friendly 720A, the controls will be divided into four groups.

- Frequency selection. This group includes band-stepping switches, the switch to select one of the two vfo's available, main tuning knob, tuning-rate select buttons, and RIT button.
- Mode Selection. These include CW, SSB, AM, FM, RTTY, and a reverse-sideband select button.

- Ancillary controls. These include the transmit/receive switch, af and rf gain controls, microphone and power output controls, noise blanker, pass-band tuning, and attenuator.
- Display. These include operating frequency, mode, sideband (u or l) and LEDs to indicate that certain functions or filters have been selected.

Operation

SSB and CW operation is straightforward. The frequency selection is made easy by the use of three tuning rates. Major changes can be made with the tuning speed button at a 1-kHz rate. The two other rates are 100 Hz and 10 Hz. The tuning knob is equipped with an adjustable brake that controls the friction on the knob. As it came from the factory, mine was too loose and had to be tightened. The rig is equipped with two vfo's and operation may be on either one or both (split), removing the need for an external vfo.

In this time of crowded band conditions, three features of the 720A make it an ideal operator's rig. The attenuator not only adds a 10-dB pad to the receiver front end, but also removes the rf amplifier. This reduces interfering signals and yields more stable reception. Pass-band tuning (PBT) accomplishes with one control what it takes other rigs two or three to do. PBT narrows the bandwidth (selectivity) of the frequencies that will pass through the crystal filter. This effectively reduces interference from nearby signals. The noise blanker, as I mentioned, is effective in reducing the interference from the woodpecker as well as the usual pulse-type trash such as ignition noise. Living out in the country where automobile traffic is about as common as QSL cards from BY-land, I parked my Subaru under a wire antenna and let it idle. If you are not familiar with this car, it is the noisiest (rf-wise) that you will run into. Letting it idle at 2000 rpm, I returned to the receiver and found the blanker to be effective.

The transmitter lived up to my expectations on SSB. With the obligatory "this is with the processor on" routine, I found that the processor had an above average or acceptable rating from the listeners. The VOX worked with no adjustment and it was not necessary to go under the top access lid.

Speaking of "under the lid," in addition to the fifty some odd controls and jacks that the 720A has on the outside, a convenient top access lid houses additional controls. CW sidetone, meter-function select, and VOX control, that require seldom adjustment, are housed under this top lid.

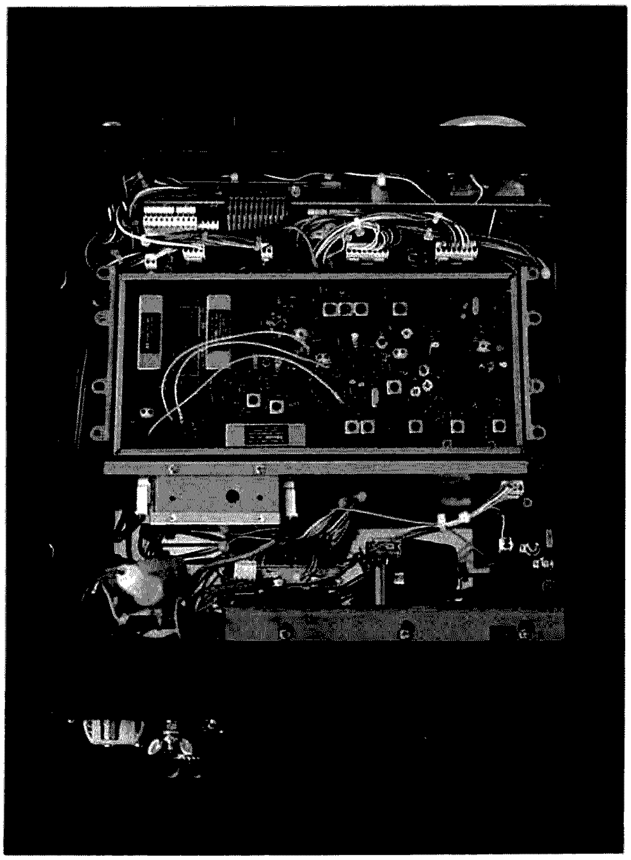
CW operation is just as easy as SSB. The rig did not have the optional 500-Hz filter, but the 1.1-kHz filter provided proved to be adequate for casual use. Upon selecting the CW mode, an LED indicates the filter width and the PBT functions as it does on SSB, allowing the PB width to be narrowed by 800 Hz. Semi-break-in is possible using the VOX switch.

Other Modes

The 720A is equipped for FSK operation and narrow shift tones are available to be sent to a terminal unit. AM operation had to be tried since there is an abundance of 75-meter phone stations here in the Northeast. Reports of "broadcast quality" were heard more than once, giving me the interest to look into this mode further. During operation in this mode, the meter measures carrier power and the operator is cautioned that if he expects to operate for more than ten minutes, power should be reduced to the 70% level.

The finals are protected by a circuit that reduces power in an inverse ratio to swr. In addition, there is a cooling fan that is activated during the transmit mode by a thermal switch. The operator's manual cautions you that should the fan go to high speed, you should *stop* operating at once. I must admit that prior to operating this radio I was a "tube final" type and somewhat nervous about solid-state finals. As I spend most of my operating time on wire antennas, using a tuner, I approached my first 720A band change with trepidation. Relieved by the rapid response of the protection circuit, I adopted a more cavalier attitude with later changes. Since I spend a good part of my time chasing HK3DMD around the bands trying to link up for our regular sked, I can now appreciate the benefits of quick band changes offered by the 720A's solid-state finals.

In summary, the Icom 720A, in the hands of this operator, has proven to be a versatile and practical ham rig. In the course of two months' operation, no major problems were encountered. While not inexpensive, the unit's distinctive features gave me hours of enjoyment and broadened my perspective. The proof of the pudding is in the eating. Should you doubt my opinions, go to your nearest dealer and try the rig yourself. I guess the strongest case for ownership of the 720A is to ask if anyone wants to buy my old rig.



Top view of the 720A. The i-f module's cover has been removed, showing the location of the crystal filters.

The Icom IC-720A and matching PS-15 power supply have a list price of $1498. For more information, contact *Icom America, 2112 116th Ave. NE, Bellevue WA 98004.*

Joe Hayes AE1K
Stoddard NH

KB1T CONTEST CALENDAR

There was a time, not too many years ago, when calendars were plain and ordinary. Functional, yes, but not very exciting. All that's changed. The walls of our homes and offices are now covered with calendars for cat haters and cat lovers, calendars from the Sierra Club and the oil companies, Right to Life and Playboy Philosophy calendars, even calendars devoted to pictures of polar bears (no kidding!). At long last, radio amateurs can join the calendar craze with one of their very own: the Contest Calendar from KB1T Radio Specialties.

The Contest Calendar is both functional and beautiful. On the functional side, it's a large, 18- x 18-inch, single sheet calendar, showing all 12 months at once. The center of the calendar features a great circle map of the Earth, centered on the USA, a handy aid to pointing your beam. Arrayed around the map are the individual calendars for the 12 months of the year. The weekends of major contests are highlighted in red with an abbreviated name of the contest and the mode (CW, phone). On the 1982 version, my count showed 28 contest weekends listed. The arrangement of the calendar on one sheet and the highlighting of the contest weekends make it easy to plan for upcoming oper-

ating activities—or anything else—at a glance.

And beautiful? The Contest Calendar is a work of art. The graphic design is bold, uncluttered and elegant. The entire calendar is printed on chromed mylar with the map in black. The 12 individual calendars have white backgrounds, with black numerals and red for the contest listings. It is the first and only ham shack accessory I have owned that non-amateurs seem to appreciate as much as fellow hams. It seems to draw more than its share of approving comments.

The Contest Calendar comes with four small adhesive tabs, allowing it to be mounted on a wall. I suspect many owners are framing theirs, however. Any active amateur, especially the contester, will appreciate the Contest Calendar. It's priced at $4.50, from *KB1T Radio Specialties, Box 1015, Amherst NH 03031*. Reader Service number 493.

Jeff DeTray WB8BTH
***73 Magazine* Staff**

PACKET RADIO BOOK

The preface to *Packet Radio*, published by Tab Books, Inc., begins by asserting, "This book was written to provide an easy entry into the utterly fascinating world of packet radio." I'm not sure that any single volume could give an *easy* introduction to this highly complex subject, but this book comes pretty close. Actually, it is must reading for anyone even mildly interested in RTTY, networking, or computer communications in general.

There is a wealth of practical information here that authors Robert Rouleau and Ian Hodgson give merely as a background to the main subject. They offer, for example, a fairly lively review of the RS-232C interface, with lots of discussion of the vagaries of interfacing nonstandard equipment. I for one was thrilled to discover that there is a pair of inexpensive chips available which convert TTL-level signals to RS-232C and back again!

The chapter on resource sharing via multiplexing should be read by everyone. It's only a basic introduction to the subject, but it is fascinating to someone who has never considered the subject before (which is to say, most hams!).

The chapters covering packet itself are solid and meaty—I won't reveal the chapter titles because they might scare off the faint-hearted. They sound more formidable than they really are.

The material on high-speed data transmission via HF radio is must reading for any ham who dreams of 9600-baud QSOs. The problems of bandwidth, S/N ratio, path loss multipath, Rayleigh fading, propagation delay distortions, and woefully unsuitable transmitters and receivers are discussed in a matter-of-fact manner. If you dream of a quick and dirty improvement to our present RTTY system, a read through this section will be a sobering experience.

The bottom line, though, is that packet techniques are being used, today, and with reasonable success. To find out more, buy this book! For information, contact: *Tab Books, Inc., Blue Ridge Summit PA 17214*. Reader Service number 496.

Paul Grupp KA1LR/4
Casselberry FL

The CES 635 Microdialer. (Photo by KA1LR)

THE CES MICRODIALER

For those who have never encountered an autodialing microphone before, it is a device designed to store several phone numbers and feed them into an FM transceiver at a predetermined speed at the press of a button. This is the basic function it must perform—but manufacturers and users alike soon discover that an autodialer must have several other features to perform adequately in the real world.

Like the Heathkit μMatic memory keyer (to be reviewed in June), the CES Microdialer is a second generation microprocessor-controlled device designed to make life a little easier for the amateur radio operator. Also like the Heathkit, the Microdialer has solved many of the problems experienced with the generation of devices that preceded it.

One of the most striking improvements incorporated into the Microdialer is found in its layout. It makes sense to have the buttons and the mike element on the same side of the microphone. Several microphones have the touchtone™ buttons on one side and the mike element on the other. These must be hung up carefully, to avoid pressing one of the buttons by accident. This is a small point, however, compared to some of the other problems the Microdialer solves.

Some owners of earlier autodialing microphones were quite chagrined to discover that their mikes occasionally suffered a glitch which locked their rig in the transmit mode. Hard luck if it happened when the rig was unattended! It was clearly injurious to the microphone, transceiver, and the blood pressure levels of others trying to use the frequency. CES cured the disease by removing the regulator chip (a source of heat) from the mike, putting in the radio instead, and tying the microprocessor's reset pin to the hangup hook. As long as the mike hanger on the vehicle's dashboard is grounded (and you use it!), there is no chance of an accidental transmission. Grounding the reset pin also lowers the mike's current drain from 120 mA off-hook to 60 mA on-hook. The dashboard in my car is plastic, so I simply ran a wire from a bolt in the firewall to one of the screws on the mike hanger. PL™ users should note that there is an extra conductor in the mike cable which can be used to enable a PL decoder when the mike is hung up and disable it when it is removed from its hanger. Nice touch!

Programmed to Please

The Microdialer really shines in the ease-of-use department. For example, when you dial a number in the automatic mode, the mike keys up the rig for .3 seconds before sending a tone—sort of a "look out equipment, here come some tones!" This feature alone allows me to use the Microdialer on several repeaters that won't accept my other dialer, which keys the PTT line at the same instant it sends the first tone.

Another welcome feature is the programmable pause. This allows you to program the autopatch access code (up to three digits) and a phone number into the same memory. The mike dials the access code, switches back to receive for two or three seconds so you can make sure that the dial tone is there, and then keys the transmitter and dials the number. If your repeater has some perverse speed requirements, you can program

the mike to send the access code at one speed and the phone number itself at another. And to make all this happen, all you have to do is push "•" and one of the numeric keys. The looks of envy you'll get from other hams when you set all this in motion are worth every penny you pay for the mike! If you are motivated by more practical considerations, consider that you can easily call home, the police, or whatever with the Microdialer, while your vehicle is in motion, without taking your eyes off the road for a second.

Entering numbers into memory is no easier or harder than with other autodialers we have tried. Memories 1 through 5 hold up to eleven digits, and 6 through 0 hold up to seven. Dialing speeds from one to eight digits per second can be programmed, and I am happy to report that there are several touchtone decoders in common use which can cope with the highest speed.

One repeater I use is plagued by a childish individual who frequently transmits tones while a user is trying to dial a number. With the Microdialer, I could bring up the patch and dial the number before our "friend" could find his or her mike.

Installing the Microdialer

If the Microdialer has any weakness, it lies in the simple fact that it involves some installation. Let's face it: There are a lot of guys who are too lazy to use a soldering iron. If a microphone doesn't come with the right plug for their rig attached, they aren't interested. To them I say, turn the page and read another article.Those of you who aren't afraid of a little work, read on!

The first thing you have to deal with is the regulator. CES solved a major problem by removing it from the mike case, but they created a minor one while doing it. You have to find a spot inside the rig for the tiny board which holds a 7805 regulator and a couple of filter caps. You also have to supply it with an unswitched source of 12 V dc. If you are using a rig over a year old, this doesn't present any problem, as there is usually lots of room for additions. I chose to use the Microdialer with my Kenwood TR-7730, one of the smallest rigs available. Getting the 12 V dc was easy—finding a spot big enough for the regulator board was not. There is a nice opening at the rear of the rig that Kenwood suggests is good for a CTCSS encoder. It may be OK for the encoder, but the rf from the adjacent final amplifier added an unhealthy dose of hum to our audio when the regulator board was put there. I finally ended up removing the internal speaker, which I never used anyway. This yielded plenty of room for the microphone's regulator and a Communications Specialists programmable CTCSS encoder/decoder board. I stored the speaker and its mounting hardware in a safe place, in case I wanted to restore it to its original condition. If there's a will, there 's a way, and if it'll fit in a 7730, it'll fit anywhere!

In Use

I found the Microdialer an extremely helpful addition to my mobile VHF installation. Compared to the microphone supplied with the TR-7730, the microphone element itself has a wider frequency response, with a noticeable improvement in lower midrange response. On the negative side of the ledger, it also has considerably less output, requiring the mike gain control inside the TR-7730 to be set much higher than previously required. This means that I cannot easily switch back and forth between the CES and Kenwood microphones.

I also found that the transmitter goes into the transmit mode for a brief moment when my sample is hung up on the grounded hanger. When I say brief, I really mean brief; It has never been long enough to bring up a repeater. I did not try the microphone with other radios, so I cannot say if this is only a problem with my particular installation or could be expected in others as well. In any case, it is not a serious problem, but you should be aware that it is there.

I am particularly fond of the microphone's shape and size. Many microphones must be held carefully, or your hand will cover the element, yielding muffled audio. You have to really work at it to make this happen with the Microdialer. It may be of little consequence to southerners, but dwellers in the land of snow and ice will be happy to hear that the microphone cable is made of a material which stays flexible at a far lower temperature than other cables we have encountered.

Another point worth noting is that when used in the manual mode, the Microdialer behaves like a normal, run-of-the-mill touchtone pad. Certain other autodialers become rather churlish in the manual mode, beeping irritably and locking up for a second or two if you try to make it do something it thinks it shouldn't be doing. Rest assured that the Microdialer is too well-mannered to engage in such loutish behavior!

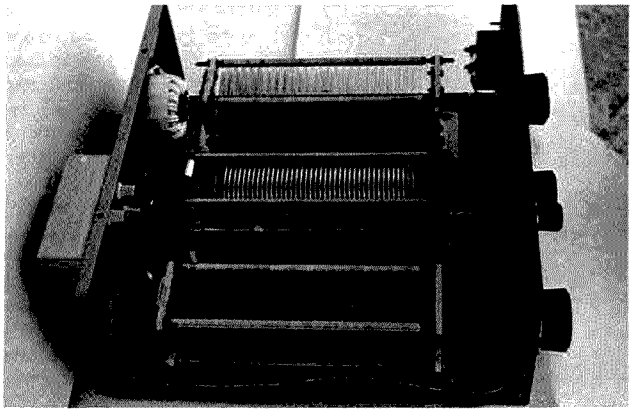
Conclusion

If you use an autopatch a lot, or frequently access your repeater's control functions, an autodialing microphone can uncomplicate your life. The CES Microdialer incorporates some much-needed improvements over previous units and is priced at $59.95 for a 500-Ω model. The only feature that Is missed is the ability to permanently store a series of numbers on a ROM chip. Maybe next year...

For more information, contact *CES, 260 W. New England Ave., Winter Park FL 32789.* Reader Service number 494.

Paul Grupp KA1LR/4
Casselberry FL

The Heath SA-2060 tuner features two meters. (Photo by N8RK)



Two variable capacitors and a roller inductor form a T-network in Heath's SA-2060 tuner. (Photo by N8RK)

HEATHKIT'S SA-2060 TUNER

It's easy to say that a tuner's a tuner, but if that's so why can you build one for next to nothing or spend over six hundred dollars for a motorized autotuning marvel? The answer boils down to power handling capability and convenience. Heathkit's model SA-2060 antenna tuner represents a good compromise between the extremes of tuner design. Selling for $254.95, it's rated to handle the full legal power limit, contains a built-in wattmeter and antenna switch, and uses a roller Inductor rather than the tapped coil used in many tuners, making it a lot easier to use than that coil-and-jumper-clips device you built as a Novice.

The SA-2060 uses the now standard T-network matching scheme and with Its roller Inductor can provide a match to some loads that tuners using tapped coils simply can't cope with. It

covers frequencies from 160 to 10 meters and can handle random wire or balanced feed antennas. A built-in 4:1 balun helps tame the wild impedances that are sometimes found when using tuned feeders.

When this kit arrived, my first thought was that there couldn't be much involved in building an antenna tuner, since at the minimum only two or three components are required. Well, when Heath tells you that you *build* this tuner, they mean it. It's up to you to assemble the two variable capacitors out of metal plates, ceramic insulators, and threaded rods. The roller inductor also needs assembly, although thankfully the coil itself is prewound.

Heath says that this kit is a three-evening project. That isn't far from the mark, although I spent considerably more time because of a modification I wanted to make (more on that later).

Although the instructions put the capacitor and coil assembly about halfway through the project, I'd suggest putting them together at the beginning so that all the little parts they use are out of your way. Assembly of the capacitors is for the most part very easy and great therapy after a hard day at work. Just keep slipping those little metal plates onto the assembly. It's a lot like threading popcorn onto a thread at Christmastime.

The rf sensing assembly for the wattmeter and the antenna switching circuitry are preassembled in a box which mounts on the back of the tuner chassis. Providing the critical wattmeter circuits already assembled and calibrated was a great move on the part of Heath. Not only did it speed up construction, but it's nice to be able to rely on their calibration (my tests show the SA-2060's meter to read within 5% of other meters used at W2NSD/1). The wattmeter actually uses two meters, one to show forward power on scales of 0-200 or 0-2000 Watts, and the second to read either reflected power (on scales of 0-50 or 0-500 Watts) or swr.

I found the reflected power mode to be easier to use than the swr mode when adjusting the tuner. All that's really necessary is to adjust for 0 Watts reflected power, so there's no need to know actual swr. Having dual meters is very convenient, since some tuning combinations can produce misleading reflected power or swr readings. By keeping an eye on both forward and reflected power, it's easy to spot these conditions and to tune for optimum settings.

The SA-2060 antenna switch provides three positions. One routes the signal through the wattmeter but bypasses the tuner, while the other two select coax-fed antennas which go through both the meter and the tuner circuitry. There's no way, however, to switch the tuner in or out of line on a specific antenna—if you want to run the antenna through the tuner, you must do so all the time. This isn't really such a bad thing, since the tuner does act as a low-pass filter and helps prevent TVI, but it is inconvenient to have to adjust the tuner before using that antenna even if the swr in the part of the band being used is low enough such that the tuner isn't really needed.

There is a serious problem with this antenna-switching scheme if you want to use both coaxial and wire-fed antennas. The random wire/balanced feed terminals are connected to the tuner *before* the antenna switch, with the result that any antenna hooked up to these terminals is always in line and will be paralleled with a coax antenna selected by the antenna switch. This renders the switching system almost useless, since before switching to a coax antenna you have to go behind the tuner to disconnect the wire one. Fortunately, the fix for this problem is rather simple if you're willing to drill a hole in the chassis and change around some wiring (see box and photo).

With the antenna switching changed as described, the tuner is a joy to use. It handles a full kilowatt with ease (although the tuner should be adjusted before running at the power level—no tuner is designed to handle the voltages that may appear when feeding a kW into 15:1 swr!), and it survived the toughest test I can think of. While driving a vee beam with full power on 80 meters, the open feeder arced through a supporting board. The feeder was burned in two and the board caught fire, but the tuner survived this rather severe mismatch with no more than a brief arc between capacitor plates. Never let it be said that we baby equipment at W2NSD/1!

In more normal use at my home station, the SA-2060 has easily matched every so-called radiator I've connected to it, including a very badly mismatched vertical, a more-than-random random wire, and a coax-fed collinear dipole that

SWITCHING MODIFICATION FOR THE HEATH TUNER

The Heathkit SA-2060 antenna-switching problem described in the review is easily correctable.

The purpose of this modification is to disconnect random wire or balanced feed antenna terminals from the tuner circuit unless switch position COAX 2 is chosen.

As originally designed, the random/balanced antenna terminals were connected to the output of the tuner *before* the antenna switch. Thus, if an antenna was connected to either of these terminals, it would always be fed in parallel with any coaxial feed antenna chosen by the antenna switch. To avoid radiating on two antennas at once, it was necessary to disconnect the wire antenna from the back of the tuner when a coax antenna was used, and no antenna could be connected to the switch position selected when a wire antenna was to be used. This arrangement rendered the antenna switch useless to those who use both coax- and wire-fed antennas.

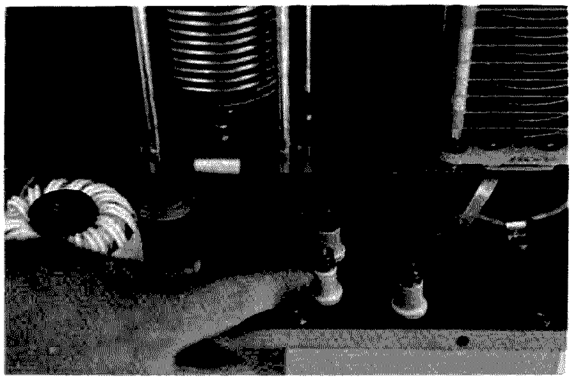
My solution was to move the connection point for the random/balanced terminals from the input of the coax switch to the COAX 2 output of the switch. Now, the wire antenna is connected to the tuner only when the COAX 2 position is selected, and a coax antenna can be used at COAX 1 without fear of feeding two antennas in parallel. The COAX 2 position can still be used to select a coax-fed antenna if no wire antenna is used.

The change involves mounting an additional ceramic feedthrough from the antenna switch box into the tuner chassis. This feedthrough is connected by a short strap to switch lug 6 inside the switch box. Lug 6 is also connected to the COAX 2 chassis connector.

The random antenna terminal is connected to the new feedthrough rather than to capacitor C2 as in the original design. No other internal connection is made to the random terminal. C2 is connected directly to the feedthrough from the switch box which was orginally connected to the random terminal. The additional parts necessary can be ordered from Heath.

After studying the layout of the tuner, the whole process is easier to do than to describe. The only cautions are to drill the new hole with enough clearance to allow the feedthrough to miss the lip of the switch box (see photo for feedthrough location) and to make sure all the rf-carrying straps have as much separation from each other and from the chassis as possible.

John Ackermann AG9V/1
***73 Magazine* Staff**



An extra feedthrough insulator was added to increase the versatility of Heath's SA-2060 tuner. (Photo by N8RK)

presented a proper match at no given frequency. This tuner replaced another inexpensive commercial one, and I've found the change to be most refreshing. I no longer have problems with being able to almost, but not quite, get a perfect match, and the built-in metering and switching (as modified) have eliminated the need for two other accessories, giving me a little more room on the operating table.

If you're in the market for an antenna tuner that includes some of the convenience features we've come to expect from the high-priced supertuners but still carries a reasonable price tag, the Heathkit SA-2060 may be your answer. The only real flaw with the unit, the antenna switching, won't bother those who don't use wire feeders, and those who do can easily cure the problem. You'll have to invest some of your time in building this tuner, but the results (and savings) can be gratifying.

For more information, contact the *Heath Company, Benton Harbor MI 49022.* Reader Service number 492.

John Ackermann AG9V/1
***73 Magazine* Staff**

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

HOBBY VIDEO

Offhand, I can think of only one occasion in my life when amateur radio and commercial video met. Since I need a justification for writing a column about hobby video in a ham magazine, let me tell you about it.

It happened on the day I took my Extra test (the time I passed). I had just left the Federal Building on New York's Varick Street with my interim permit clutched firmly in my fist. As I was making my way over to Washington Square to catch the subway back home, I suddenly noticed in front of me a bunch of klieg lights, cameras, and a typical Greenwich Village street with cars and street signs of an early-1960s vintage.

"Could you hold it a minute, fella?" a man in a light-colored windbreaker asked me.

"Sure," said I. "Hey, what's going on here?" I inquired, asking the obvious, as usual.

The guy in the windbreaker paused for a second, looked me over very closely, and said: "It's okay. Go on ahead. Your clothes fit into the period, anyway." So, with that I slipped between two wooden barriers and continued my eastward march.

I'm about halfway along the block when a taxi comes tearing down the street with a 1959 Chevy sedan in hot pursuit. The cab smashes into a fire hydrant directly across from me and two rough types jump out of the car and put the collar on the taxi driver. It was, of course, a part of a movie—a TV movie, as it turned out. And the Panavision camera caught me as a horrified onlooker. I later saw the movie on ABC, but I guess my scene landed on the editing room floor—I wasn't in the completed film.

So, that was the day broadcast television and ham radio made almost simultaneous appearances in my life. Listen, it may not be the greatest story ever told, but at least it gave me a lead to this month's column.

On a wildly different note, I know someone who is writing a high-school electronics textbook. As a plug for ham radio to a potentially ripe audience, this chap thought he would include some information about the OSCAR satellites in his book. My friend wrote to the ARRL asking for a couple of black and white photographs so that his readers could get an idea of what an amateur-built satellite looks like.

The upshot of his efforts, sad to say, was a letter from HQ saying that the League's OSCAR photos are for use only in their own publications and "are not for dissemination to the general public." Wonderful. So the League doesn't want the general public to know what the OSCAR satellites look like. It's a great boost to our hobby when only hams can find out about OSCAR.

All in all, another tidbit of information to remember the next time a League official lets loose some of that babble about your dues going toward more than just a magazine subscription. Phooey!

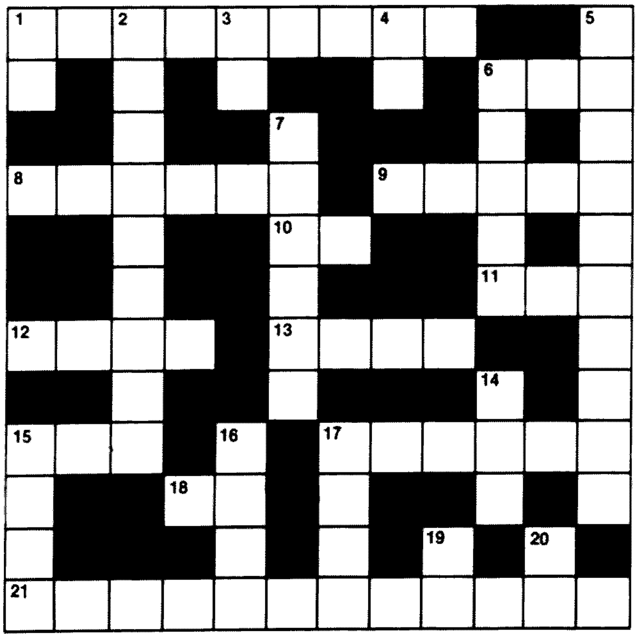


Illustration 1.

ELEMENT 1—CROSSWORD PUZZLE (Illustration 1)

Across

1) Curves formed by the intersection of a cone with a plane parallel to its side.
6) Satellite TV preamp (abbr.)
8) TV bird
9) A TV distribution medium
10) Not color TV (abbr.)
11) Relative (abbr.)
12) Money: kilo ________
13) Satellite home video (abbr.)
15) Shorting buzz
17) Satellite TV "belt"
18) Our continent (abbr.)
21) User's end of satellite system (2 words)

Down

1) Board type (abbr.)
2) Another TV bird (2 words)
3) LNA transistor (abbr.)
4) Antenna mount: ________
5) Man-made moons
6) The human work needed to install a home satellite system
7) Satellite motions
14) Hobby video is entering a new ________
15) Rent a VCR
16) Composer you may hear on "Bravo"
17) Broadcaster's slang for a compact tape package
19) Antenna tuner (abbr.)
20) Yes opposite

ELEMENT 2—MULTIPLE CHOICE

1) Where did Howdy Doody live?

		1 I	2 H	3 D	4 A	5 F	6 B	7 E	8 D	9 C
10 I		11 C	12 J	13 G	14 J	15 B	16 K	17 A	18 C	19 H
20 G	21 F	22 F		23 B	24 K	25 C	26 B	27 I	28 J	
29 E	30 H	31 E	32 A	33 D	34 A	35 F		36 E	37 B	38 J
39 G		40 F	41 F	42 F	43 G		44 C	45 G	46 D	

Illustration 2.

1. Doodyland
2. Doodyville
3. Doodytown
4. Newington CT

2) Of the following television personalities, which one isn't (or wasn't) a ham?
1. Andy Devine
2. Arthur Godfrey
3. Dick Van Dyke
4. Stu Gillam

3) On *The Man From U.N.C.L.E.*, what was the name given to the communications link used by Napoleon Solo and Ilya Kuryakin?
1. Channel 19
2. Five-two direct
3. Interlink 12
4. Channel D

4) Who is ABC's science editor?
1. Hector Fuentes
2. Roy Neal
3. Jules Bergman
4. Murray Greshner

5) What is the present location of RCA's Satcom III?
1. Over the Pacific Ocean
2. Over the Atlantic Ocean
3. Over the Indian Ocean
4. Nobody knows

P	A	R	A	B	O	L	A	S			S
C		C		P			Z		L	N	A
		A			O				A		T
W	E	S	T	A	R		C	A	B	L	E
		A			B	W			O		L
		T			I				R	E	L
B	U	C	K		T	V	R	O			I
		O			S				E		T
H	U	M		B		C	L	A	R	K	E
I			N	A		A			A		S
R				C		R		A		N	
E	A	R	T	H	S	T	A	T	I	O	N

Illustration 1A.

ELEMENT 3—TRUE-FALSE

	True	False
1) The first TV movie ever made starred Ronald Reagan.	____	____
2) Home Box Office is owned and operated by the *Washington Post* and *Newsweek*.	____	____
3) Of the estimated 3.9 million people who viewed the 1947 World Series on television, 3.5 million were situated in bars.	____	____
4) The "Overmyer Network" was a 1960s attempt at forming a fourth TV web.	____	____
5) The first experimental TV station was W2XBS.	____	____
6) There's no "Channel One" because the FCC forgot to allocate it.	____	____
7) The CBS system for color television would have required a mechanical disk rotating on the front of your TV picture tube.	____	____
8) Wayne Green once worked as a TV cameraman at WPIX-TV, Channel 11, in New York.	____	____
9) The first patent for a device that could send pictures by wire was granted to a German in 1919.	____	____
10) An episode of *Hazel* dealt with the problem of TVI. On this show, Mr. Baxter's reception of a golf telecast was ruined by a local ham.	____	____

ELEMENT 4—HAM ACROSTIC
(Illustration 2)

Guess the words defined and write them over the numbered dashes. Next, place each letter in the correct square in the puzzle. The black squares show word endings. The completed puzzle will form a statement relating to this month's topic.

A) VCR format.............................. 17 34 4 32

B) Signal interfaces...................... 6 37 15 26 23

C) Goes with picture..................... 25 44 18 9 11

D) TVRO antenna angle................ 46 8 3 33

E) Videotape "outs"....................... 36 31 7 29

F) Satellite's job............................ 40 5 35 42 41 21 22

G) What cable companies like to bring against pirates.................... 43 45 20 39 13

H) International radio-TV body...... 30 19 2

I) Opera house seen on "Bravo".... 1 27 10

J) TVRO setup can cost this.......... 28 12 38 14

K) Iraq prefix................................. 24 16

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1—2 There's no Doody in Newington.
2—3 But his agent is.
3—4 Remember? They had those little HTs that never seemed

to be limited in range or vulnerable to jammers.

4—3 Roy Neal works for NBC, Murray Greshner is the cop on *The Odd Couple* and I don't know who the heck Hector Fuentes is.

5—4 Satcom III (not to be confused with its replacement, Satcom IIIR) was lost shortly after launch. Nobody knows for sure where Satcom III is, but I understand they're watching some great movies up on Pluto.

Element 3:

1—True	*The Killers*, in 1963. It was his last acting job—on screen, anyway.
2—False	Time-Life.
3—True	And make that a double, please.
4—True	It didn't work.
5—True	Operated by NBC in New York.
6—False	There is a Channel One, but we call it "6 meters."
7—True	The FCC thought RCA's all-electronic system was somewhat better.
8—True	Smile.
9)—False	Paul Nipkow was granted a German patent for such an instrument in *1884*!
10—True	And I've got a recording of the program to prove it!

Element 4:
See Illustration 2A.

SCORING

Element 1:
Twenty-five points for the completed puzzle, or ½ point for each question correctly answered.

Element 2:
Five points for each correct answer.

Element 3:
Two and one-half points for each correct answer.

Element 4:
Twenty-five points for the completed puzzle, or one point for each correct answer.

So, do you know the difference between a plate and a dish?

1-20 points—Sees only snow
21-40 points—Dish pointed at Earth
41-60 points—Fuzzy picture
61-80 points—Sharp black and white picture
81-100 + points—Closed-circuit image

READER'S CORNER

Last January's puzzle concerning the five stations and their DX schedules provoked a sizable flurry of mail — some of it indignant. As a few of you discovered, there were actually *three* solutions to this puzzle. Here they are:

		M	U	L	T	I	P	O	I	N
T		D	I	S	T	R	I	B	U	T
I	O	N		S	Y	S	T	E	M	
P	I	R	A	T	E	S		D	O	N
T		M	I	S	S		O	U	T	

Illustration 2A.

	Name	Call	Working Now	Working Next
1.	Bob	W1WW	Korea	Mongolia
	Dan	W1YS	Mongolia	Hong Kong
	Jack	W1XT	Hong Kong	Japan
	Pat	W1BX	Japan	Taiwan
	Tom	W1JO	Taiwan	Korea
2.	Bob	W1WW	Taiwan	Mongolia
	Dan	W1YS	Mongolia	Hong Kong
	Jack	W1XT	Japan	Korea
	Pat	W1BX	Korea	Taiwan
	Tom	W1JO	Hong Kong	Japan
3.	Bob	W1WW	Taiwan	Mongolia
	Dan	W1YS	Mongolia	Hong Kong
	Jack	W1XT	Hong Kong	Japan
	Pat	W1BX	Korea	Taiwan
	Tom	W1JO	Japan	Korea

Gail Graham W5MLY worked out a beautiful Pascal program to solve this problem on a North Star Horizon computer. I wish I could print the run here, but it's much too long to fit within this column's limited space. I just wish to thank Gail on a magnificently executed job. And thanks, too, to everybody who wrote in.

Winners:

Found 3 solutions: Jerry Wetzel W3DMB, Gail A. Graham W5MLY.

Found 2 solutions: Mark E. Zaleski KA8BPY.

Found 1 solution: Michael S. Bilow N1BEE, Jim Connolly KA1UI, Harry D. Thomas KA1NH, Larry D. Peterson N2AMW, Hank Wellburn WA2JOX, John Wilcox KS4B, B. B. Jessee III N4DEK, Dallas W. Wilson KA6EOL, Roberta Horton KA7CUY, Daren Horton WB7VDJ, Richard C. Sowler W8FEM, Ricahrd C. Bonar WD8ORI, Kent S. Doub KF8Z, Daryl L. Waite K9JPQ, Bob Koelling KCØBL, Jerry Moore WØHMA.

Didn't find a solution, but either tried or made a puzzle comment: N2AMS, KA3IBI, WD4DAH, WD4ODS, WD9ATJ, KA9BAI, KA9KAW, KB9RR, KL7RA.

FCC

Reprinted from the Federal Register

Expansion of the Telephony Segments of the High Frequency Amateur Radio Service Bands

AGENCY: Federal Communications Commission.

ACTION: Notice of inquiry and proposed rule.

SUMMARY: The Commission proposes to make additional segments of the 14 MHz amateur band available for telephony operation. The Commission is also inquiring about making additional segments available for telephony operation in the other high frequency (HF) amateur bands (those amateur bands between 3 and 30 MHz). Congestion on the frequencies currently authorized for telephony use is causing the employment of this mode to become increasingly difficult. The proposed rules revision would help alleviate this situation in the 14 MHz band. The inquiry looks towards finding a suitable set of frequencies for telephony expansion in the other HF amateur bands.

DATES: File comments on or before July 1, 1982, and reply comments on or before August 2, 1982.

ADDRESS: Federal Communications Commission, Washington, DC 20554.

FOR FURTHER INFORMATION CONTACT: Steve Lett, Private Radio Bureau, (202) 632–7597.

SUPPLEMENTARY INFORMATION:

Adopted: February 11, 1982.

Released: February 24, 1982.

Introduction

1. Notice of Inquiry and Proposed Rule Making in the above-entitled matter is hereby given.

2. The Commission has before it at this time seven petitions for rule making which request that the Amateur Radio Service Rules (Part 97) be amended by provide for the use of telephony operation (emission types A3 and F3) on additional portions of the amateur high frequency (HF) bands—the bands between 3 and 30 MHz. Six of the petitions propose some particular portion of certain bands for additional telephony authorization. Four of the petitions propose that additional telephony privileges be divided among or limited to certain operator classes. The petitions are described in the following paragraphs.

3. RM–3705, submitted by Philip Galasso and received by the Commission on 18, 1980, requests that the frequencies 3750–3775 kHz, 7050–7100 kHz, 14100–14200 kHz, 21200–21250 kHz and 28200–28500 kHz be added to those authorized for telephony in the United States. It further requests that these additional telephony privileges only be granted to Amateur Extra Class operators and that power input during such operation be limited to 250 watts. The petition claims that expansion of frequencies for telephony operation is warranted due to congestion on the currently authorized telephony subbands and under-utilization by U.S. stations of the frequencies proposed for expansion. Lack of use by U.S. amateurs is attributed to incompatibility between telegraphy operation currently authorized for U.S. stations and telephony operation in common use by

foreign stations. Operator class and power restrictions are requested by the petition to help ". . . assure minimum interference to the existing radiotelephone users of these frequencies. . . ."

4. RM-3729, submitted by David Novoa and received by the Commission on June 30, 1980, requests that the frequencies 7075–7100 kHz and 14175–14200 kHz be allocated for exclusive use by Amateur Extra Class licensees and that telephony operation be authorized on these frequencies. This petition also cites crowding on existing telephony subbands and incompatibility of domestic telegraphy operations with foreign telephony operations as reasons for expanding the telephony subbands. The petition further claims that protection for foreign amateurs from powerful U.S. stations is no longer necessary and that foreign stations, in fact, favor a subband expansion which would enable them to engage in an exchange of telephony communications with U.S. stations on a single frequency.

5. RM-3734, submitted by James Simon and William Bennett and received by the Commission on August 1, 1980, requests that the frequencies 3750–3775 kHz, 7050–7150 kHz, 14100–14200 kHz, 21200–21250 kHz and 28400–28500 kHz be made available for telephony use by U.S. amateurs. This petition again cites overcrowding on currently authorized telephony subbands and lack of further need for protection of foreign stations as reasons for its request.

6. RM-3778, submitted for the Willamette Valley DX Club by Robert Herndon and received by the Commission on October 7, 1980, requests that the frequencies 3750–3775 kHz, 7050–7100 kHz, 14100–14200 kHz, 21200–21250 kHz and 28400–28500 kHz be authorized for telephony operation since, it contends, "the United States no longer has the dominant amateur population and there is little reason to think that the expansion of U.S. amateur (telephony) privileges into previously reserved frequencies will result in undue hardship on foreign amateurs." The expansion is necessary, it claims, to relieve congestion on currently authorized telephony subbands.

7. RM-3831, submitted by Ronald Kramer and received by the Commission on November 7, 1980, petitions the Commission to increase the portion of each amateur frequency band between 1.8 and 30 MHz available for voice (telephony) communication and correspondingly decrease the portion of each band available for telegraphy communications. The petition claims this is necessary since the telephony mode is becoming increasingly popular.

8. RM-3833, submitted by Fred Huntley and received by the Commission on January 13, 1981, requests that "Extra Class Amateur Radio licensees be granted radiotelephone operation privileges between 7.100 and 7.150 MHz" and that "(s)uch operation be authorized a maximum power input of 250 watts." The petition proposes that this additional operation be on a shared basis with existing Novice class operations. Relief of congestion and interference on the existing telephony segment of that band is cited as necessitating this action.

9. RM-3860, submitted by the American Radio Relay League (ARRL) and received by the Commission on March 9, 1981, requests that the frequencies 14150–14200 kHz be added to those authorized for telephony use and that operator privileges on the revised telephony portions of the 14 MHz band be changed to the following: 14150–14175 kHz, Amateur Extra Class only; 14175–14225 kHz, Amateur Extra and Advanced Classes; 14225–14350 kHz, Amateur Extra, Advanced and General Classes. The petition cites growing congestion in the present telephony subbands as warranting expansion of the subbands. The operator privilege changes are proposed by the petition in the interest of lessening the impact of telephony subband expansion on foreign amateur operations.

Background

10. The Commission has traditionally designated particular portions of the heavily used HF amateur frequency bands for operation using certain emission modes, while only permitting other modes on different portions of the bands. These designations have served to segregate incompatible operating modes. Since the early days of radio, simultaneous use of incompatible modes on the same frequencies has worked to the mutual detriment of communications using all modes. Placing certain emission modes on different frequencies avoids this type of interference and has the further beneficial effect of indicating to amateur operators where, in the amateur bands, to seek out certain forms of operation.

11. The subband allocations [1] have also been arranged to protect international amateur radio operations. Foreign operators have consistently, in the past, objected to expansion of U.S. subbands for increasingly popular, wide bandwidth emissions such as telephony.[2] They have claimed that such an expansion would create a situation where high powered U.S. stations would overrun low power foreign stations and effectively prohibit the foreign stations from using those bands.

12. Protection of foreign stations has also benefited U.S. operators desiring to contact them using telephony. The U.S. operator can listen for the foreign stations in a portion of the band where strong U.S. signals are not present [3] and then reply on frequencies within the U.S. telephony subbands. The foreign operators then listen for the U.S. stations in the U.S. telephony subbands.[4]

13. Current regulations permit emission type A1 Morse telegraphy operation on all amateur radio frequencies. This unique universal authorization for that mode results from its character as an efficient and widely recognized communications language that can be employed with the simplest type of equipment. In the amateur 160 meter band (1800–2000 kHz) type A3 telephony operation is currently permitted on all frequencies. In all HF amateur bands roughly half of the band may be used for A3 or F3 telephony emissions. The limitations on telephony operation in most of the HF bands were instituted in order to prevent such operation from overwhelming telegraphy operations as well as to protect international operations. Type F1 digitally coded emissions (radioteletype) are permitted in all portions of the HF bands where telephony operation is not permitted since this type of operation is more harmonious with type A1 operation. The only other modes permitted on the HF bands, emission types A5 and F5 "slow-scan" television operation and emission types A4 and F4 facsimile operation, require a bandwidth approximately equivalent to telephony operation and consequently are permitted in the telephony subbands.[5] This current state of subband allocation in the HF amateur bands is the result of the Report and Order in the last proceeding dealing with expansion of the telephony subbands.[6]

14. Small portions of the various subband allocations are reserved for Amateur Extra Class and Advanced Class licensees. These portions were set aside to help provide an incentive for amateurs to upgrade their license operator class. This program of reserved operator privileges resulted from the proceeding dealing with incentive licensing and distinctive call signs.[7]

Proposal

15. The Commission proposes to expand telephony privileges in the 14 MHz amateur band by adding the frequencies 14150–14200 kHz to those currently authorized for such use. We feel this action is warranted due to the extreme congestion experienced by amateurs on the existing 14200–14350 kHz telephony subband. Although the various petitions' requests ranged from a subband that would start as low as 14100 kHz and extend to 14350 kHz, to a subband that would start as high as 14175 kHz and extend to 14350 kHz, we have selected a starting point of 14150 kHz to propose as a compromise between competing objectives. We anticipate that our proposal would provide substantial relief to the current overcrowding in the 14 MHz telephony subband while causing only a minimal disturbance to international operations. The increasing sophistication of equipment used by both foreign and domestic amateur operators leads us to believe that foreign stations should not experience undue interference from U.S. operations and that U.S. amateurs attempting to contact foreign stations should have less difficulty using single frequency operation (as opposed to "split operation") than they have had in the past. We propose retaining the frequencies 14100–14150 kHz for traditional weak signal and other international operations by not changing the modes authorized on those frequencies.

16. Since we do not anticipate a significant detrimental impact on international operations from our proposal, and since we desire to provide the maximum relief possible from the current overcrowding, we propose to make all of the additional telephony subband frequencies available to Amateur Extra Class, Advanced Class and General Class operators. To this end, we have specifically proposed to not change any of the operator privileges. However, we invite comments as to whether it would be desirable to delete from General Class operators the privileges between 14150 kHz and 14200 kHz, and instead, add privileges between 14225 kHz and 14275 kHz to those authorized for General Class operators. In this way, the telephony subbands available to General Class operators will be contiguous. Also, consistent with our action in PR Docket 80–252 to permit the use of television and facsimile on most portions of the HF bands where telephony is permitted, we propose to include the use of type A4, A5, F4 and F5 emissions in the new 14150–14200 kHz subband allocation. We are not proposing a stricter power limitation for the additional subband allocation since we do not feel this would make any significant contribution toward avoiding interference.

Inquiry

17. The 14 MHz amateur band has one of the two smallest telephony subband allocations and is, perhaps, the most popular HF amateur band due to its reliability for long distance communications. Because of these factors, we believe that crowding on this band is severe enough to transcend much of the controversy surrounding telephony subband expansion, and for this reason we have set forth a specific proposal for that band. However, we are not proposing expansion of any of the other telephony subbands between 3.5 and 29.7 MHz because we feel the issues involved are too inadequately defined for us to commit ourselves to any particular course of action. Instead, we invite the submission of comments and supporting information with which these issues may be clarified. The Commission recognizes that the existing telephony subbands are often seriously overcrowded. However, we request commenters to weigh the magnitude of this problem against the issues addressed in the following questions:

A. Would expansion of the telephony subbands have a major detrimental impact on domestic telegraphy operations?

B. Do non-U.S. stations still have a legitimate requirement to be protected, on some frequencies, from U.S. telephony operations?

C. Does the current trend toward the use of transceivers (with a common transmit and receive tuner) make the reservation of frequencies suitable for contacting foreign stations using "split operation" unnecessary or undesirable?

D. Should additional subband allocations for telephony be contiguous with the existing telephony subbands?

E. Would it be appropriate to relocate the existing Novice subbands to new frequencies within the same HF bands in order to make a telephony subband expansion more orderly?

F. Are the current exclusive subbands for Amateur Extra and Advanced Class operators sufficient to meet the goals of our incentive licensing program if all additional telephony frequencies are authorized to General as well as Amateur Extra and Advanced Class operators?

G. How should the recent expansion of the Canadian telephony subband in the 7 Mhz band influence proposals for a U.S. telephony expansion in the same band?

18. We also encourage commenters to make specific recommendations as to what frequencies would be best suited to use for additional telephony privileges and the relative occupancy of those frequencies. Comments about related matters not explicitly mentioned above are also invited.

Conclusion

19. Notice is hereby given that it is proposed to amend 47 CFR Part 97 in accordance with the proposals set forth in the attached Appendix. Notice is also given of inquiry into the matter discussed above.

Procedural Matters

20. For purposes of this non-restricted notice and comment rule making proceeding, members of the public are advised that *ex parte* contracts are permitted from the time the Commission adopts a notice of proposed rule making until the time a public notice is issued stating that a substantive disposition of the matter is to be considered at a forthcoming meeting or until a final order disposing of the matter is adopted by the Commission, whichever is earlier. In general, an *ex parte* presentation is any written or oral communication (other than formal written comments/pleadings and formal oral arguments) between a person outside the Commission and a Commissioner or a member of the Commission's staff which addresses the merits of the proceeding. Any person who submits a written *ex parte* presentation must serve a copy of that presentation on the Commission's

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[1] The term "subband" is popularly used to describe a segment of a frequency band where authorized modes of emission or authorized operator class privileges are different from those in other portions of the same band. This term is used throughout the text for the sake of clarity.

[2] Depending on the specific emission mode employed, telephony operations in the HF amateur bands occupy a bandwidth roughly between 3 kHz and 7kHz. The more popular telephony modes in use today (principally A3J single sideband) occupy somewhat less than 4 kHz. On the other hand, telegraphy emissions used in the HF bands (both A1 and F1 types) occupy less than 1 kHz.

[3] This portion of a band, where domestic telephony operation is not permitted and where operators listen for foreign stations to contact, is commonly known as the "DX window."

[4] This form of operation where an amateur transmits to a station on one frequency and listens for the station's reply on another frequency is commonly known as "split frequency operation."

[5] Authorization of emission types A5 and F5 "slow-scan" television operation, along with types A4 and F4 facsimile operation, in entire HF telephony subbands was the subject of the proceeding in PR Docket 80–252. See Report and Order, 47 FR 2872, January 20, 1982.

[6] Report and Order in Docket 19162, 37 FR 21325, October 7, 1972.

[7] Report and Order in Docket 15928, 32 FR 12682, September 1, 1967.

Secretary for inclusion in the public file. Any person who makes an oral *ex parte* presentation addressing matters not fully covered in any previously-filed written comments for the proceeding must prepare a written summary of that presentation; on the day of oral presentation, that written summary must be served on the Commission's Secretary for inclusion in the public file, with a copy to the Commission official receiving the oral presentation. Each *ex parte* presentation described above must state on its face that the Secretary has been served, and must also state by docket number the proceeding to which it relates. See generally, Section 1.1231 of the Commission's rules, 47 CFR 1.1231. A summary of the Commission's procedures governing *ex parte* contacts in informal rule makings is available from the Commission's Consumer Assistance Office, FCC, Washington, DC 20554, (202) 632-7000.

21. Authority for issuance of this Notice is contained in Sections 4(i), 303(r) and 403 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 303(r) and 403. Pursuant to applicable procedures set forth in Section 1.415 of the Commission's Rules, interested persons may file comments on or before July 1, 1982, and reply comments on or before August 2, 1982. All relevant and timely comments will be considered by the Commission before final action is taken in this proceeding. In reaching its decision, the Commission may take into consideration information and ideas not contained in the comments, provided that such information or a writing indicating the nature and source of such information, is placed in the public file, and provided that the fact of the Commission's reliance on such information is noted in the Report and Order.

22. In accordance with § 1.419 of the Commission's rules, 47 CFR 1.419, formal participants must file an original and five copies of their comments and other materials. Participants who wish each Commissioner to have a personal copy of their comments should file an original and eleven copies. Members of the general public who wish to express their interest by participating informally may do so by submitting one copy. All comments are given the same consideration, regardless of the number of copies submitted. All documents will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, DC.

23. The Commission has determined that Sections 603 and 604 of the Regulatory Flexibility Act of 1980 (Pub. L. 96-354) do not apply to this rule making proceeding since the proposed rules would only change operating practice. These changes would not compel amateur operators to purchase new equipment and consequently would have no significant economic impact on them or any small businesses, small organizations or small governmental jurisdictions.

24. It is ordered that the Secretary shall cause a copy of this Notice to be served upon the Chief Counsel for Advocacy of the Small Business Administration and that the Secretary shall also cause a copy of this Notice to be published in the Federal Register.

25. For further information on this proceeding contact Steve Lett, Federal Communications Commission, Private Radio Bureau, Washington, DC 20554, (202) 632-7597.

(Secs. 4, 303, 307, 48 Stat., as amended, 1066, 1082, 1083; 47 U.S.C. 154, 303, 307)

Federal Communications Commission.
William J. Tricarico,
Secretary.

Appendix

PART 97—AMATEUR RADIO SERVICE

It is proposed that paragraph (a) of § 97.61 of the Commission's Rules and Regulations, 47 CFR 97.61, be amended as follows:

In the table in that paragraph, the row beginning with "14200-14350 (kHz)" would be revised by beginning the row with "14150-14350 (kHz)" so that the entire row reads as follows:

* * * * *

14150-14350 ...... A3, A4, A5, F3, F4, F5

§ 97.61 [Amended]

HAM HELP

Does anyone have information on the whereabouts of VP6LX (April, 1963) or W2PCJ/KJ6 (August, 1963)?

George Oster K0EDA
524 6th St.
West Des Moines IA 50265

Can anyone suggest a cure for the rf feedback coming out of my TS-130's headphones and speaker when I use 10-meter phone?

Marvin Rosen N3BQA
20 W. Madison St.
Baltimore MD 21201
(301)-685-6308

I would like to hear from collectors of antique radios.

Ed Best AK4W
2004 University Dr.
Durham NC 27707
(919)-489-2164

I am looking for any information on changes that can be done to a Heathkit HW-101 to better its performance or add extra features.

Gary Johnson WD8SDO
6616 Maplewood Ave.
Sylvania OH 43560
(419)-882-0121

I would like to have a copy of the manual, circuit diagram, and crystal information on the Standard SR-C146 two-meter handheld transceiver.

Dennis Sladen VE1BZJ
Site 16A Box 4, RR#4
Armdale B3L 4J4
Nova Scotia, Canada

I am in need of a schematic, manual, and alignment instructions for an E. H. Scott Laboratories AN/SRR-3 WWII Navy receiver.

Cal Cotner K4JSI
5324 N. 27th St.
Arlington VA 22207

CORRECTIONS

"The Masher," an article in the March, 1982, issue of *73*, has a capacitor incorrectly labeled. C3 in Fig. 2 and on the parts list should be a 1-uF capacitor.

Power Gain Systems' new product announcement in the March, 1982, *73* had an incorrect phone number. Power Gain Systems can be reached at (318)-325-4754. Since publishing the prices for the coaxial dipole, *73* has learned that the antennas now list for $44.95 and $49.95.

Tim Daniel N8RK
***73 Magazine* Staff**

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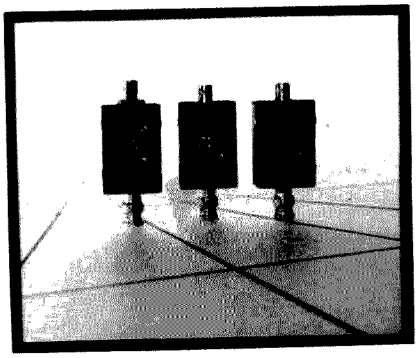

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from page 105

include door prizes every hour, indoor vendors, a flea market, and nets and group meetings. Food and drink will be available. Talk-in on 146.19/.79 and 147.86/.26. For further information, write Jack R. Thompson KA4RKS, 637 Wolf Road, Covington KY 41015, or call (606)-291-2153.

MUNCIE IN
MAY 23

The 3rd annual Muncie Area Amateur Radio Club Hamfest will be held on May 23, 1982, from 8:00 am to 3:00 pm at the Ball State University indoor track building, Muncie IN. Tickets are $2.00 in advance or $3.00 at the door. All activities are under a roof and there will be forums, prizes, refreshments, and parking available. Flea market tables are $4.00 on a first-come basis, and setup will be 6:00 pm to 1:00 am on Saturday and 6:00 am to 7:45 am on Sunday. Talk-in on 146.13/.73, 146.52, and 223.10/24.70. For further information, contact Terry Evans WD9HQH, 522 S. Brotherton, Muncie IN 47302, or phone (317)-282-0615.

FREETOWN MA
MAY 23

The Fall River Amateur Radio Club will hold its flea market on Sunday, May 23, 1982, from 10:00 am to 4:00 pm at the American Legion Hall, Freetown MA. Admission is $1.00 and flea market spaces are $7.00 in advance or $9.00 at the door (the table price includes 2 admissions). Free coffee will be available. Talk-in on 147.63/.03 and .52. For space reservations, send a check payable to Fall River Amateur Radio Club to Ann M. Carro KA1DNB, 652 Old Colony Terrace, Tiverton RI 02878.

GEORGETOWN IL
MAY 23

The 13th annual Danville Area Hamfest will be held on May 23, 1982, at the fairgrounds in Georgetown IL. The gates will open at 6:00 am. Adult tickets are $2.50 in advance and $3.00 at the gate; children under 14 years of age will be admitted free. There will be a free outdoor flea market area (please bring your own tables, chairs, and power cords). The indoor area will be available at additional cost. Overnight camping, with or without water and electrical hookups, is $5.00 per vehicle per night. Activities will include door prize drawings, family entertainment, forums, and much more. Refreshments, free coffee, and free parking will be available. Talk-in on 146.22/.82 and 146.52. For more information on tickets and/or tables, contact Wendell Lyons KA9AYS, Hamfest Chairman, 903 Polk Street, Danville IL 61832 or phone (217)-431-2124.

PITTSBURGH PA
MAY 23

The 28th annual Breeze Shooters Hamfest will be held on May 23, 1982, from noon to 5:00 pm at the White Swan Park, Rte. 60 (Parkway West), near the Greater Pittsburgh International Airport, Pittsburgh PA. Registration is $2.00 or three for $5.00. Activities are a free flea market, prizes, a CW contest, and a family amusement park. Sheltered tables for vendors are available by advance registration only. Talk-in on 146.28/.88 or 29.0. For further information, contact Joe Kyler K3SJD, 4430 Evergreen Road, Pittsburgh PA 15214, or phone (412)-931-2756.

PARAMUS NJ
MAY 23

The Bergen Amateur Radio Association will hold a Swap 'n Sell on May 23, 1982, from 8:00 am to 4:00 pm at Bergen Community College, 400 Paramus Road, Paramus NJ. Buyers will be admitted free. There will be tailgating only and spaces are $3.00 (bring your own tables). For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

FREMONT OH
MAY 23

The Ohio Radio Club and the Ottawa County Amateur Radio Club will hold a hamfest on May 23, 1982, at the fairgrounds in Fremont OH. Dealers may set up at 7:00 am and gates will open at 8:00 am. Advance tickets are $2.50 and $3.00 at the door. Talk-in on .31/.91 and .52. For table reservations and tickets, send an SASE to John Dickey W8CDR, 545 N. Jackson Street, Fremont OH 43420.

WEST FRIENDSHIP MD
MAY 30

The Maryland FM Association will hold its annual hamfest on Sunday, May 30, 1982, from 8:00 am to 4:00 pm at the Howard County Fairgrounds, West Friendship MD (about 30 miles west of Baltimore). Admission is a $3.00 donation, tailgating is $3.00, advance reserved tables are $6.00 each, and tables at the hamfest will be $10.00. Talk-in on 146.16/.76 and .52. For more information, write MFMA Hamfest Committee, Post Office, Harmans MD 21077. For table information and reservations, contact John Elgin WA3MNN, 5495 Apt. 2, Harpers Farm Road, Columbia MD 21044, or phone (301)-596-3741.

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

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ARGENTINA	21	21	14A	14	14	7A	14	21	21A	21A	21A	21A
AUSTRALIA	21	21	14	14	7B	7B	14B	14B	14B	14B	14	21
CANAL ZONE	21	14	14	14	14	7	14	14	21	21	21A	21A
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WEST COAST	21	14	14	7	7	7	7A	14	14	14A	21	21

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CANAL ZONE	21	14	14	14	14	7	14	21	21	21A	21A	21A
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U. S. S. R.	14	7	7	7	7	7	7	14B	14	14	14	14
EAST COAST	21	14	14	7	7	7	7A	14	14	14A	21	21

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair G = Good
P = Poor * = Chance of solar flares; # = of aurora

MAY

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G/G
2 G/G	3 G/G	4 G/F	5 G/F	6 G/F	7 G/G	8 G/G
9 G/F	10 G/F	11 G/G	12 G/G	13 G/G	14 G/G	15 G/G
16 G/F*	17 F/F*	18 F/F*	19 F/F	20 F/F	21 G/F	22 G/G
23 G/G 30 G/G	24 F/P 31 G/G	25 F/P	26 G/G	27 G/G	28 G/G	29 G/F

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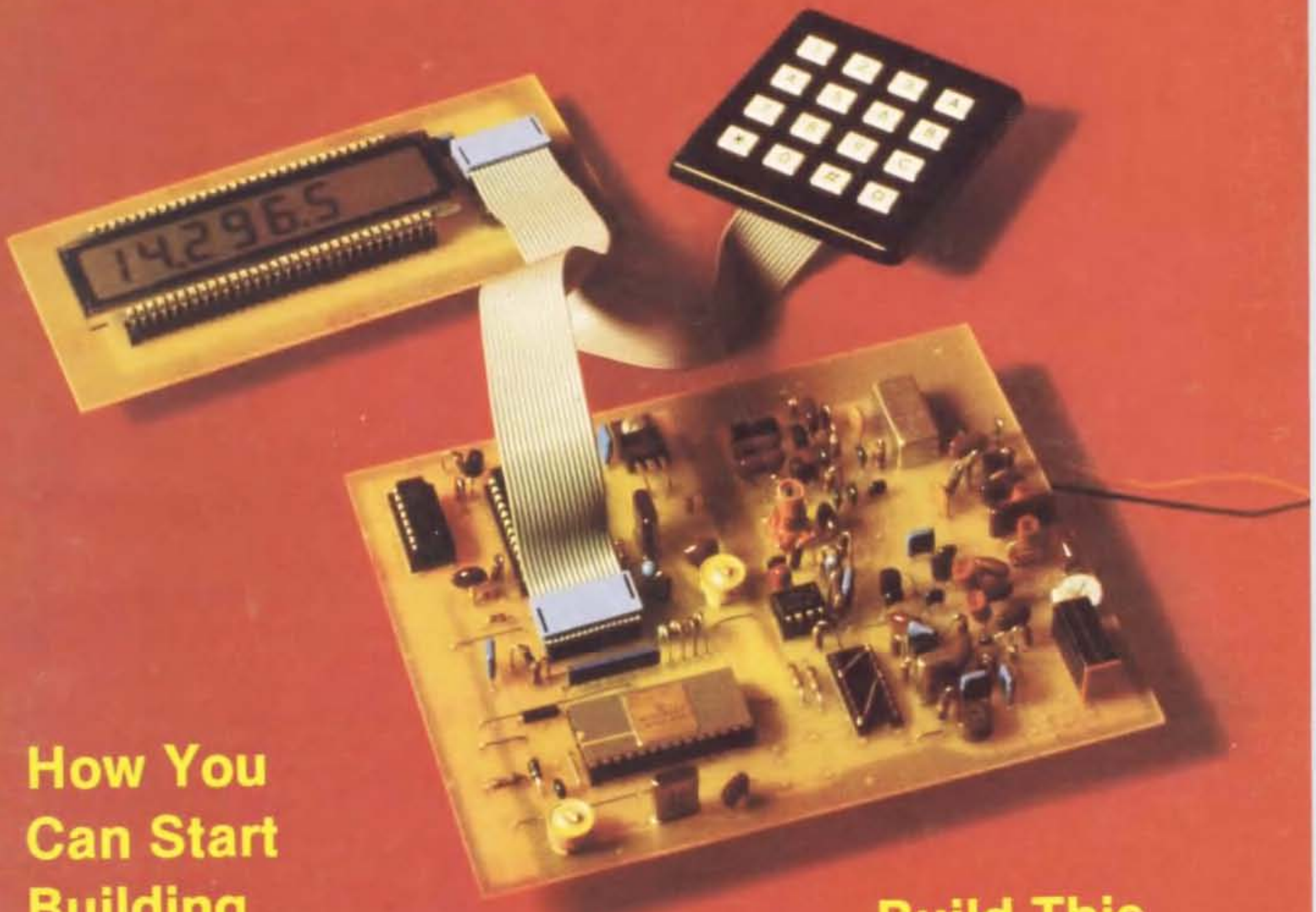
73 MAGAZINE FOR RADIO AMATEURS

TVRO Receiver Project



How You Can Start Building

Build This Digital Vfo

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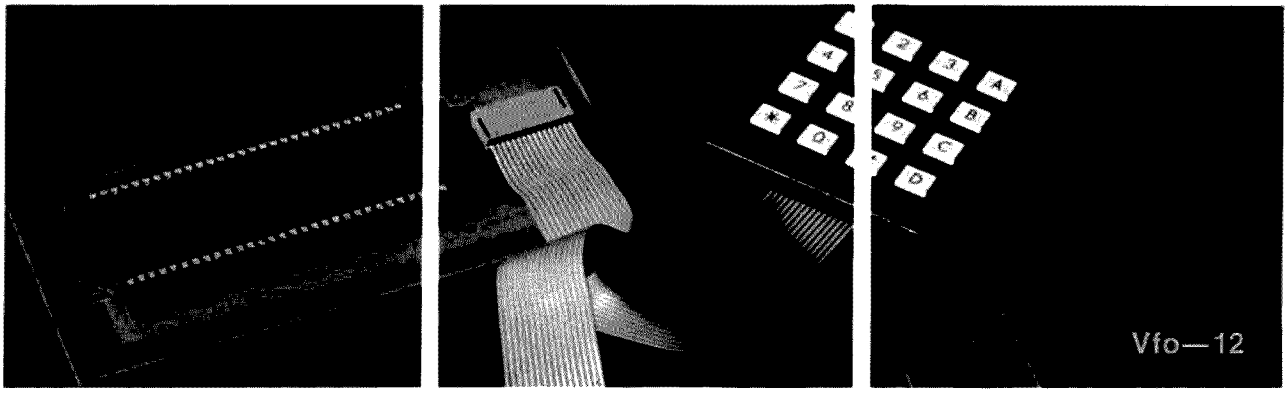
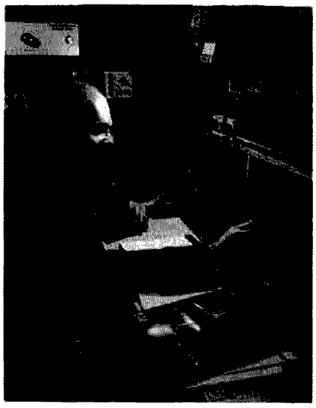
73 MAGAZINE
Vol. XXII No. 9



W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



HOOKED

You know, after over forty years of hamming I still don't know exactly what it is that grabs the interest of a teenager and turns him from a normal rotten kid into a raving electronic maniac. I'm told by the doddering grey-bearded old-timers who have taken over most of the ham clubs in the country that youngsters are exposed to the whole world on television and thus find little exciting about talking to weird places.

Hmmm. I'm not convinced. No, amateur radio didn't gradually die off. It was killed with one blow back in 1963. Before that it had been growing at 11% per year for 17 years, right on up through the evolution of television. TV never even slowed it down.

My first exposure to amateur radio must have made a strong impression, because after 50 years I still remember it. Yep, sonny, I was a shaver of ten and while visiting the best friends of my grandparents in Bethlehem, New Hampshire, I met Harry Stevenson W1CUN. His mother, along with Johnny Macauley, ran the Valley View Inn. That was back in the heyday of hotels in Bethlehem. . .30 hotels and 100 rooming houses, the billboard at the entry to town said.

Harry was sitting there laconically talking on a 75m rig. . .a breadboard construction with a big copper tube final coil. He didn't pay a lot of attention to the visiting kid. It didn't occur to me, at ten, that I might ever be able to understand the wizardry of that mass of wires and tubes.

Like a time bomb ticking away, that experience lay hidden, waiting for the spark of puberty to set it off. By 14, I was already familiar with the excitement of the police calls at the top of the broadcast radio dial. Then all it took was an exposure to a fantastic radio my grandfather in Littleton, New Hampshire had. . .with a shortwave band on it! Wow! There were all those foreign broadcast stations. . .and a myriad of hams. I was a roly-poly kid, but the family still had trouble tearing me away from the twenty-meter ham band to eat.

It was at just this juncture that some fiend dumped a box of radio parts in my lap one Sunday at church. Most of the parts were brand new and in their original cartons, so I couldn't just throw them away. Oh, I tried to sell them to the local radio repairman (now gone the way of the ice man), but he sneered at the parts as antiques. *Popular Mechanics* had a radio construction project each month, many of them using parts just like those in my collection, so I put together a radio in an old cigar box. . .and unfortunately it worked. I was hooked.

HOME-BREW CONTEST WINNERS

- 1st place, $250 prize: "Smart Squelch for Single-Sideband Receivers" by Frank Reid W9MKV and David Link W9YAN, both of Bloomington IN.
- 2nd place, $100 prize: "Six-Meter Double-Sideband QRP Transmitter" by Larry Jack KL7GLK of Annapolis MD.
- Honorable mention, $50 each: "MB-1 Function Circuit" by Mike Strange WA2BHB, Pine Hill NJ, "Splattometer" by Penn Clower W1BG, Andover MA, and "Weather Converter for Your Two-Meter Rig" by Paul Danzer N1II, Norwalk CT.

We're sure you have heard it said that "hams are not building anymore; they're just appliance operators." Well, *73*'s Home-brew Contest proves that rumor to be baloney. We were literally buried with entries. The winning projects show that hams are not only building, but that they are still innovating, too.

Our editorial staff burned the midnight oil in early April, choosing five finalists from more than 100 entries. The winners were then picked by three of *73*'s veteran home-brewers: AG9V, K1XR, and W1XU.

The Home-brew Contest winners will be published in future issues of *73*. In the meantime, keep your soldering iron hot—*73* is having another contest. This time there will be a $50 limit for the project's parts.

$$ HOME-BREW II CONTEST $$

Between now and October 1, we'll be looking for articles describing the best home-brew projects in the land for under $50. All useful projects will be published in *73*, and the cream of the crop will share $500 in cash prizes. Top prize in the contest is $250, with $100 going to the second place project and $50 to each of three honorable mentions. These prizes are over and above the payment that all authors receive for having their articles published in *73*.

Contest Rules

1. All entries must be received by October 1, 1982. To enter, write an article describing your best home-brew construction project, and submit the article to *73 Magazine*. Any construction article received before the October 1 deadline is automatically entered in the contest. Any entries for the first Home-brew Contest which meet the $50 requirement for Home-brew II will be automatically entered. If you haven't written for *73* before, please send an SASE for a copy of our author's guide.
2. The total cost of the project must not exceed $50, even if all parts are purchased new. Be sure to include a detailed parts list, with prices.
3. All parts used in the project must be available to the average radio amateur or electronics experimenter. To be on the safe side, include sources for any unusual components.
4. Projects will be judged by the *73* technical staff on the basis of usefulness, reproducibility, economy of design, and clarity of presentation. The decision of the judges is final.
5. All projects must be original, i.e., not previously published elsewhere.
6. All rights to articles purchased for publication become the property of *73 Magazine*.

Send your entries to:

Home-Brew II Contest
73 Magazine
80 Pine Street
Peterborough NH 03458

Winners will be announced in the December, 1982, issue of *73*. Have fun!

Tim Ahrens WA5VQK
Microcomponent Applications
Engineer, Motorola
3501 Ed Bluestein Blvd.
Austin TX 78721

Build This Digital Vfo

—a microprocessor makes it simple

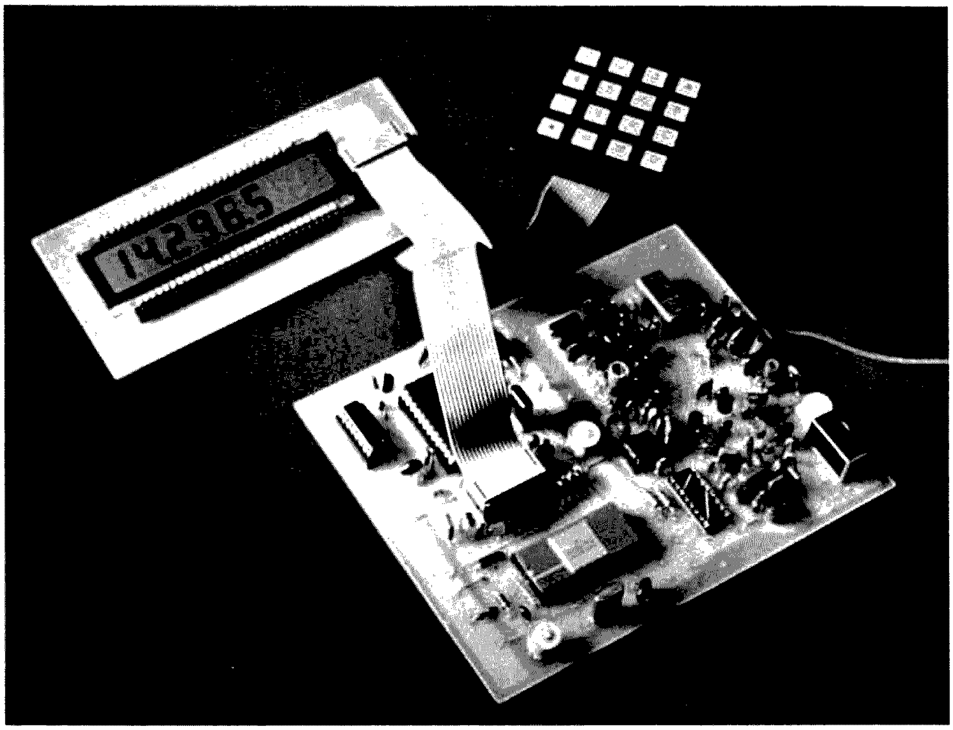
Ed. Note: The MC6805T2L2 microprocessor IC used in this project must be ordered directly from Motorola. Send a money order only (no checks) for $11.50, payable to Motorola, to: Tim Ahrens, Motorola, 3501 Ed Bluestein Blvd., Austin TX 78721, Attention: Mail Stop L-2787.

This article describes a microprocessor-controlled vfo which may be used as a remote vfo for existing stations or incorporated into new radio-system designs. The vfo features ten battery-backed-up memories, keypad entry of frequency, up/down scanning, a real-time clock, plus a liquid crystal display.

As a remote, the vfo tunes from 5 to 6 MHz in 100-Hz increments and is directly compatible with radios which use a 5-to-5.5-MHz internal vfo (e.g., FT-107, FT-707, etc.). If using one of these radios, only small modifications within the radio are required to allow the remote vfo to change bands at the touch of a finger!

Microprocessor Selection

The vfo is designed around Motorola's MC6805T2 microprocessor. Within this multi-function chip (now called a microcomputing unit—MCU—because of all the integrated functions on board), I/O plays a very important part. This is the portion of the MCU which does the actual communicating with switches, LEDs, bells, and whistles. The MC6805T2 MCU used in this project (we will refer to it as the "T2") has a small amount of RAM, ROM (2.5 K bytes), a timer, parallel I/O lines, and one other feature that makes it ideal in the radio environment—a built-in frequency synthesizer. A block diagram of the synthesizer is shown in Fig.1(a); Fig.1(b) is a block diagram of the entire vfo.



The vco signal which is fed back into the T2 may have an amplitude as low as one-half volt and be as fast as 16 MHz. With external prescaling, the vco frequency may be considerably higher. However, any external prescaling will multiply the step size by the prescaling factor.

In addition to its on-chip synthesizer, the T2 contains enough ROM to hold all the software needed for the vfo control program. In fact, the T2 with the vfo program in ROM is available from any Motorola distributor.

An alternative to the T2 is the MC68705P3 MPU. The P3 is very similar to the T2 except that it requires an external synthesizer and it contains on-board EPROM instead of ROM. The EPROM on the P3 is user-programmable, so you should use the P3 if you need a control program other than the one avail-

able in ROM on the T2. See the box for further information on programming and use of the P3.

The circuit-board layouts given in this article can be jumpered for use with either MPU. The figures and text explain where differences occur. For those who prefer not to etch their own boards, a source for boards as well as components is given in the small box.

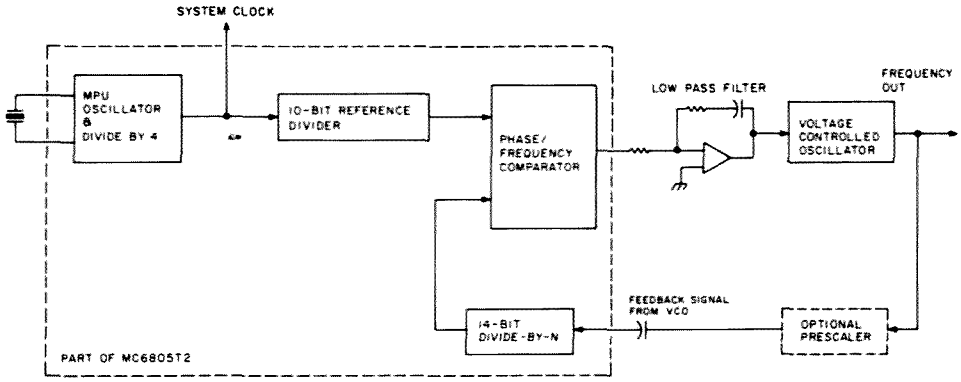


Fig. 1(a). Block diagram of synthesizer on MC6805T2 MCU chip.

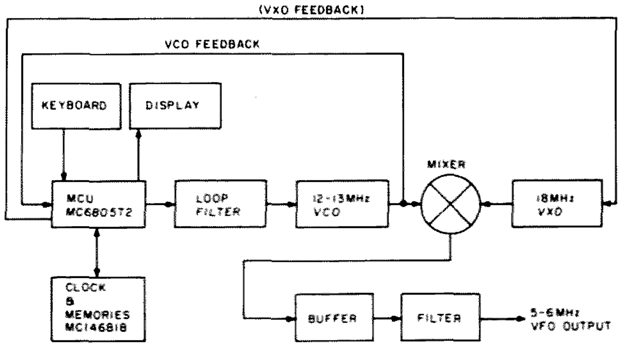


Fig. 1(b). Block diagram of entire microprocessor-controlled vfo.

Using the Vfo

Upon power-up, the MCU reads the last-entered frequency from the RAM on board a battery-backed-up MC146818 clock chip, enters it into the synthesizer, and displays it. If powering up from a "dead" system (no battery backup), garbage will be both displayed and entered into the PLL system.

After the power-up sequence is completed, numbers for a different frequency may be entered via the keyboard. When the display shows the frequency desired, depress "enter" and the PLL system will be set up. By entering the frequency in this manner, it is also stored in RAM so that if a power failure should occur, the correct frequency will be read from the battery-backed-up system and the PLL restored.

If the displayed frequency is to be stored into memory for later recall, press "memory" followed by a digit, 0-9. To retrieve a previously stored frequency, press "recall" followed by the desired digit. All of these memories have battery backup.

If you want to move up in frequency, press and hold the "up" button. If you want to go up fast, press and hold the "fast" button at the same time. The frequency will go up until it reaches XX.999.9, at which time it will roll over to XX.000.0. To make the system go down in frequency, the same procedure may be followed using the "down" key.

To set the time, press "recall" followed by "memory." At this time, the display will show EEEEEE, signifying that the time may now be entered. Enter the time in 24-hour format, and when satisfied with the display, press "enter." At this time, the data will be placed into the clock chip's registers and time-keeping will commence. When "enter" is depressed, the frequency that was on the display before setting the clock will be restored to the display. The actual PLL systems are not disturbed by entering into either this mode or the time-display mode.

To display the time with an update every second, press "recall" followed by "enter." You may exit this mode by pressing any key, which will return the display to the previous frequency.

As you can see, the combination of the MC6805T2 MCU and the MC146818 clock chip provides the radio designer with capabilities that far surpass the previously acceptable methods of frequency control. The 6818 may be omitted, but the clock feature, stored frequencies, and the battery backup of them will also be deleted.

Vfo Circuit Design

The rf circuitry I used is given in Fig. 2, while the MCU and its peripherals are shown in Fig. 3.

As the MCU's minimum step is 1 kHz, some method of refinement must be incorporated because 1 kHz is not adequate resolution in the HF bands. By using four of the I/O lines from the MCU for a voltage-summing network, 100-Hz stepping increments may be realized. The output of the summing network is used as an "offset" voltage to shift the frequency of the vfo. Because the frequency will be locked (basically to itself), changing the main vco frequency would achieve nothing. There are, however, two methods of

PARTS AVAILABILITY

The varactor diodes (D2 and D3) and most of the integrated circuits used in this project are Motorola devices and are available from Motorola distributors. In many parts of the country, Hamilton-Avnet Electronics is a source for these parts. Excluding the LCD unit, a set of ICs for this project should cost between $45 and $70, depending on which microprocessor you select for your version.

The MD108 double-balanced mixer is available for $12 postpaid from ANZAC, 180 Cambridge St., Burlington MA 01803. A good selection of coils and forms can be found at RADIOKIT, Box 411S, Greenville NH 03048.

Parts, as well as circuit boards, are also available from Conversion Dynamics, 2218 Old Middlefield Way, Suite N, Mountain View CA 94043. Their version uses a double-sided PC board and an LED rather than LCD frequency display. Write to them for more details.

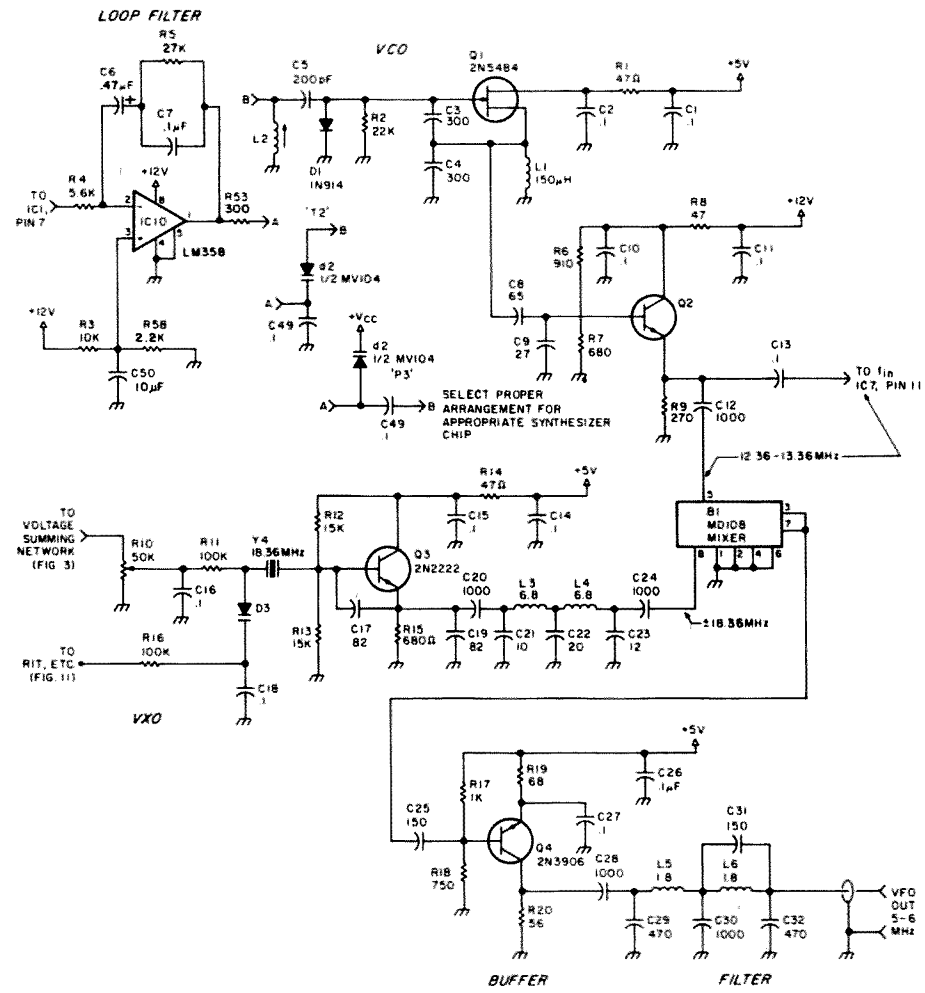


Fig. 2. Rf circuitry of vfo.

changing the frequency which would not affect the PLL system itself: Shift the reference frequency, or use an auxiliary variable crystal oscillator (vxo) and then mix the two frequencies together.

The first method was tried initially, but due to the low frequency of the crystal, I could not pull the oscillator far enough off frequency to provide the 100-Hz shift and still have provisions for RIT. So the second method, of an auxiliary vxo, was tried. The main vco tunes from 12.36 to 13.36 MHz and is then mixed with 18.36 MHz from the vxo to provide the necessary 5-to-6-MHz signal. This method of shifting through 100-Hz steps may seem a bit crude, but several commercial transceivers use this method. In fact, Icom's IC-730 uses this method to generate 10-Hz steps! Fig. 4, a spectrum analyzer photo, shows the actual vfo output.

The 18.360-MHz vxo crystal (Y4) was chosen because I had one; it is a 146.88-MHz transmit crystal for an HT-144. Either of two crystals may be used in the oscillator. An 18.360-MHz or an 18.860-MHz crystal may be selected by a jumper and a pullup/pulldown resistor on pin 27 of IC1 (see Fig. 3). The vco must be adjusted for the crystal you choose.

If a different frequency range is to be covered by the vfo, the frequency of the vxo crystal must be changed, and appropriate modifications in the filters should be made. From this, it may be seen that almost any frequency may be generated from the vfo by simply changing the vxo crystal.

The MCU and Clock Circuit

A version of the MC6805T2 is available from Motorola which already contains in ROM the program necessary to function as a vfo. This part is called an MC6805T2L2. The L2 signifies a specific program within a ceramic part, in this case, the vfo software. The MCU is used to gather data from the keyboard and execute any function which is "called up." The lines used for I/O are represented by PA0-PA7, PB0-PB7, and PC0-PC2. Port A is used for both the keyboard and interface to the MC146818 clock chip. In this application, the clock chip is battery-backed-up, and when powered down draws only 300-400 microamperes from a four-and-one-half-volt source.

The B port is used to control the four bits of the voltage-summing network plus the read/write and control lines of the clock. The C port is used to control the clock and data lines of the liquid crystal display (LCD). Only two crystals are required in this part of the vfo—a 4.096 MHz for the MCU, and a 4.194 MHz for the clock chip. These frequencies are divided down by their respective hosts for internal timing.

All of the peripherals with the exception of the 6818 are serial devices. This means that the digital data which goes to each part requires only two lines, a data line and a clock line. In the MCU environment, I/O lines are at a premium; that is why data lines are common to all parts and only the clock or enable lines are separated from the rest.

The Display

The display portion of the system uses the MC145000 multiplexed LCD driver and an 8-digit LCD, although only six digits are used.

The MC145000 requires a total of four lines—power, ground, clock, and data. This means that the display may be located away from the main PC board. This makes for a lot easier construction of the total project! Since this is digital data on two of the lines, use no more than about a foot of cable. Current consumption is quite low with this CMOS device—about 75 microamperes. As data is shifted into the 145000, every 8 bits will shift over one character from left to right. Even if only the right-hand-most digit is to be

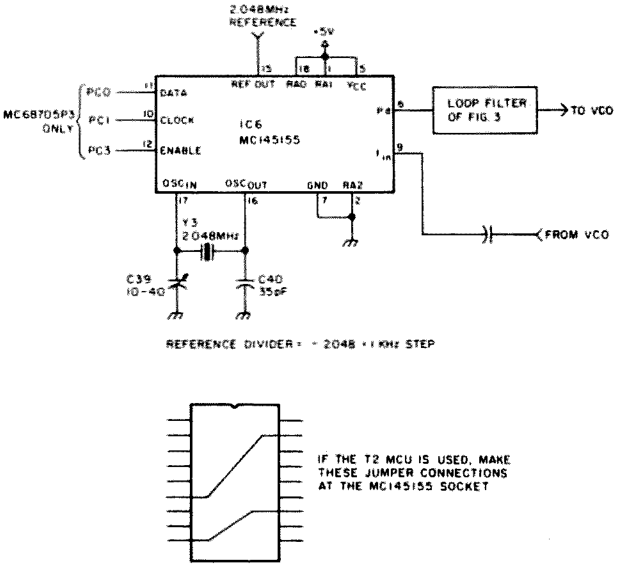


Fig. A. Using the MC145155 CMOS synthesizer.

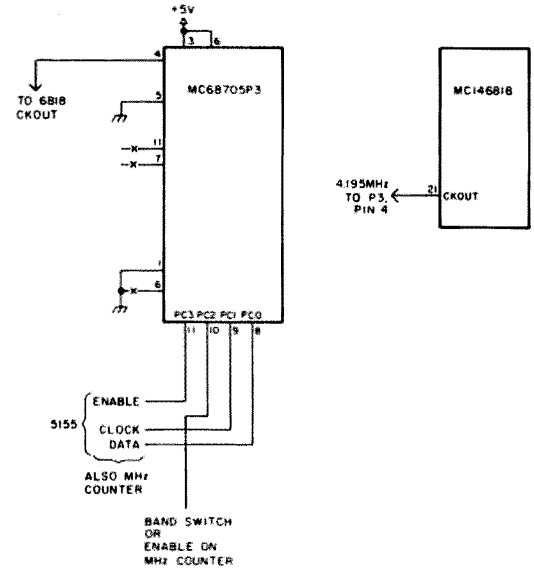


Fig. B. 6805 T2 vs. P3 differences.

Using the P3

Although designed for the MC6805T2, the vfo software was given the capability of using the MC68705P3 as a host MCU. This MCU is identical to the T2 with the following exceptions: • The P3 does not contain a PLL. • The P3 is an EPROM-type part which programs itself.

In the early stages of the design, a T2 was not available and a "simulation" was made by using a P3 and an MC145155 CMOS synthesizer. If changes to the program are desired, you may use a P3 plus an MC145155 CMOS synthesizer to simulate the T2, as shown in Figs. A and B. This allows you to use the same basic core of the program and add enhancements that might be useful.

The actual software listing for the system is available from me on receipt of a large SASE plus $3.00 to cover copying costs. It may be entered into an MCM2716 2K by 8 EPROM for programming of the MC68705P3. Fig. C is a schematic for the programmer.

The MC68705P3 MCU has the capability of programming itself. By adding only one additional part (MC14040B), the P3 can read data from a 2K by 8 EPROM and program itself from it. Two LEDs are used, which signify that the device has been 1-programmed, and 2-verified.

Because the hardware required to program the P3 is so small, even the casual amateur/hobbyist may build a programmer to take advantage of the MCU's capabilities.

Either the T2 or the P3 with the MC145155 can be used with the circuit board presented in this article. If the T2 is used, the MC145155 is not needed and two jumper connections should be made at the MC145155 socket. See Fig. A.

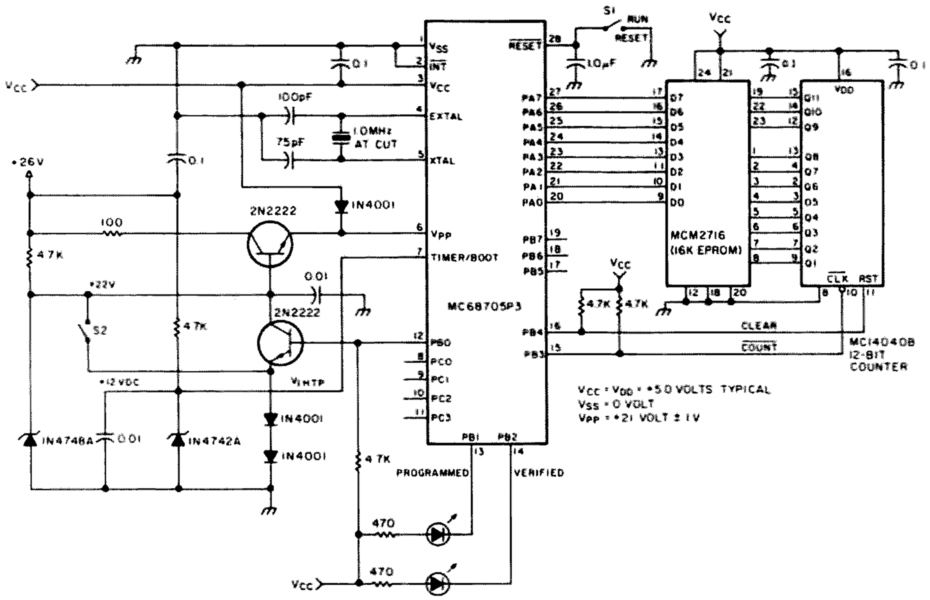


Fig. C. Programmer for the P3.

Reader Service for facing page ↗81→

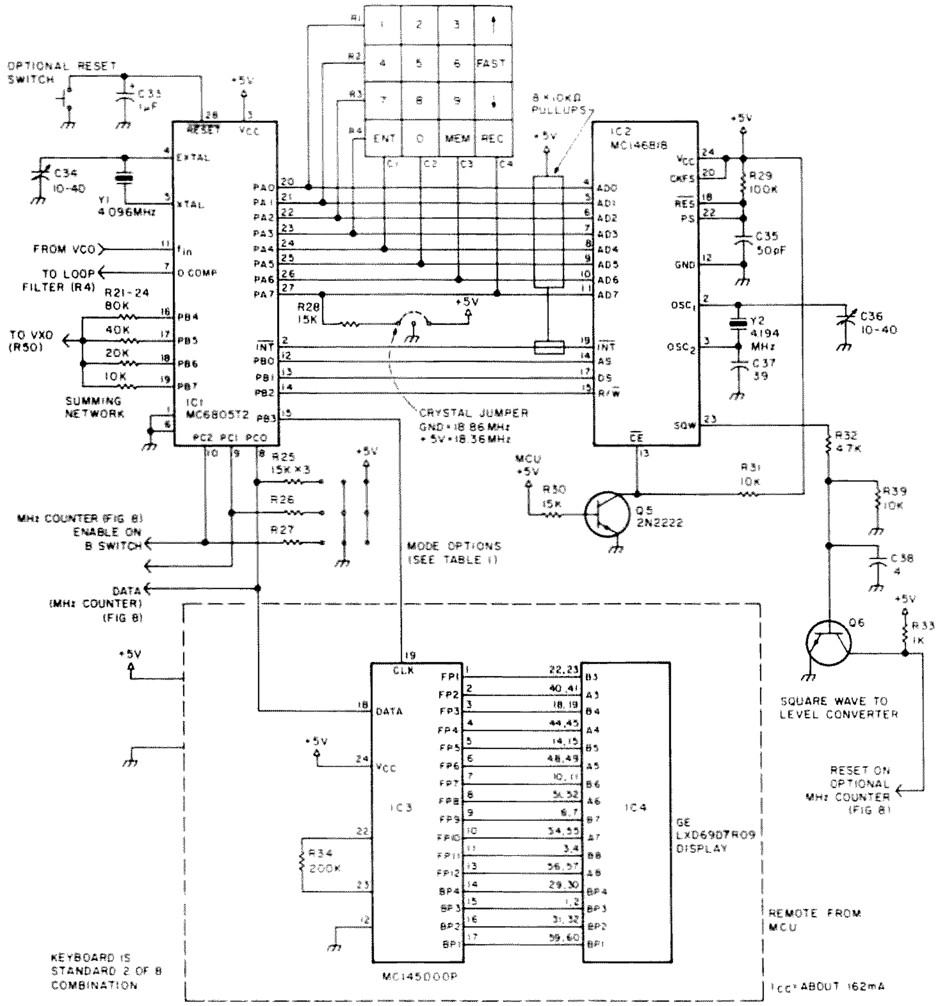
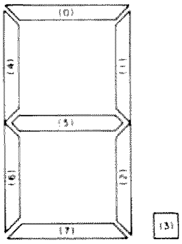


Fig. 3. MCU and peripherals.



Displayed Digit	Display Format Hex Code
0	D7
1	06
2	E3
3	A7
4	36
5	B5
6	F5
7	07
8	F7
9	B7
A	77
b	F4
C	D1
d	E6
E	F1
F	71
P	73
Y	B6
H	76
U	D6
L	D0
blank	00
— (dash)	20
= (equal)	A0
n	64
r	60
°(degrees)	33

Note: A decimal point can be added to all but the right-most display digit by setting b3 [segment (3)] to a 1.

Fig. 5. Display codes of LCD readout.

changed, all 6 digits must be present to the 145000 (48 bits worth). Fig. 5 is a chart which relates bits to digit segments.

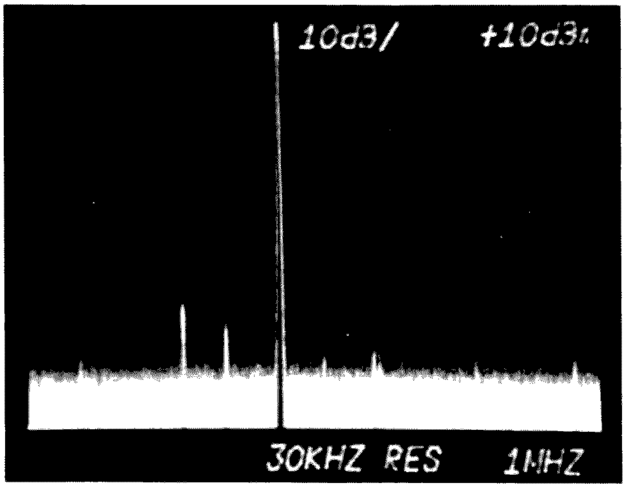


Fig. 4. Vfo output displayed on spectrum analyzer.

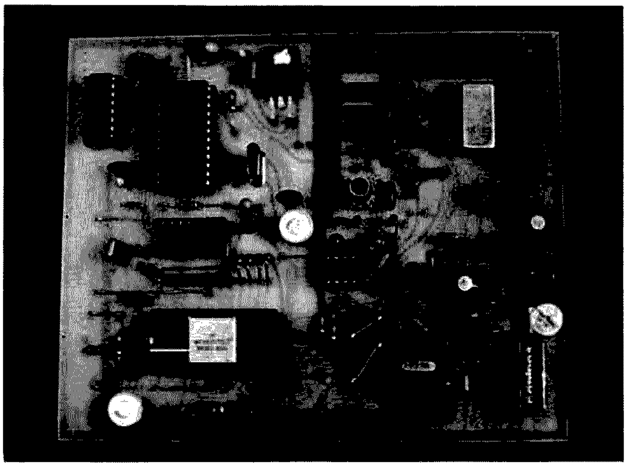
The Real-Time Clock

The MC146818 is a new device which not only has a real-time clock in it, but also contains 50 bytes of CMOS RAM. This makes the device an excellent choice, since data in the RAM may easily be saved in a power-down condition.

The 6818 has a clock generation circuit on chip which requires only a crystal, resistor, and two small capacitors to generate not only the time clock source, but also a clock signal for the rest of the system if desired. If the crystal mode is not chosen, the 6818 may be driven with an external frequency of 4.195 MHz, 1.048 MHz, or 32.768 kHz. An internal register tells the 6818 which frequency it is on. I have found that the 6818 draws less power when operating at the lowest frequency—32.768 kHz. In fact, by using an MC14069 inverter as a crystal oscillator at 32.768 kHz, less power is used than by using a 4.194-MHz crystal on the 6818! As with most parts of this type, the faster the clock, the more current required.

The MC146818 may be set up in a 12/24-hour type mode, plus alarms which may be set to interrupt at any time, including every hour, minute, or second. As shown in Fig. 6, there are 14 registers required to set up this data, and the entire memory map looks like 64 RAM locations.

Although the MC146818



Main circuit board, using the MC6805T2L2 MPU. If the alternate "P3" MPU is used, then the socket with jumpers at lower center would be replaced with an MC145155P synthesizer chip. The empty socket at left is for the plug-in cable to the keypad. At upper right is a metal can containing the double-balanced mixer.

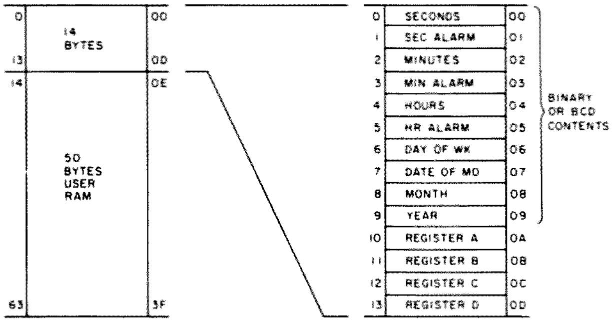


Fig. 6. Registers of the MC146818 clock chip.

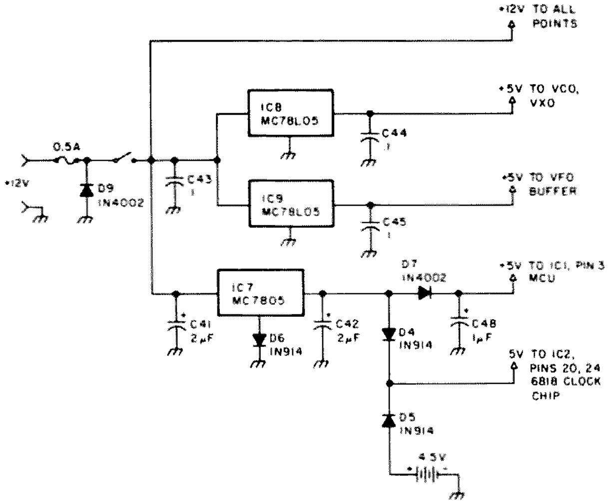


Fig. 7. Power supply. The regulated 12 V dc which drives this supply can often be derived from your transceiver. Otherwise, a simple 12-V-dc, 1-A source should be constructed.

clock chip is not designed to have any I/O pins, there is one way in which a single output bit may be "constructed." The SQW pin is a software-programmable clock output pin whose frequency is a derivative of the 6818's clock. The internal register which controls the frequency of the SQW pin can not only change the frequency of the pin, but it may also turn it off. By setting the frequency of the SQW to some relatively high frequency (it is not really that important) and providing some external filtering, when the clock is on, the output of the filter represents a "one" condition, and when off, represents a "zero" condition! This provides an extra I/O pin.

Power Supply

To supply the MC146818 with voltage both when the main system is off and on, there need to be a few smarts involved. See Fig. 7. The trick required is to use D6 to initially raise the 5 volts from IC7 one diode drop higher (.7 V), then drop the supply voltage (Vcc) to both MCU and 6818 by separate diodes (D4 and D7). This ensures that both parts are operating at basically the same voltage. For battery-backup operation, D5 is inserted from the plus lead of the battery to pin 20 of the 6818. This isolates the batteries from the rest of the system and doesn't allow any current to flow back into them when the main Vcc is on. If you are using nicads, a resistor of appropriate value could replace the diode to allow charging during on time. The value of this resistor is of little consequence to the 6818 when the main power is off because the current consumption of the 6818 is so low.

In addition to the voltage differential, there is another consideration regarding the chip enable (CE) line of the 6818. When the system is powered down (main power), the CE line of the 6818 should be brought high to ensure that the part is deselected. This is easily accomplished by using a transistor (Q5 in Fig. 3) in the classical inverter style. The base is tied to the MCU Vcc (through an appropriate resistor), and the collector resistor is tied to the 6818 Vcc. When the system is on, the collector is low, enabling the 6818, but it goes high when the system gets turned off.

The Keyboard

Because I/O lines are so valuable, each one commonly is given more than one function. Of course, every effort has been made to keep the number of lines required to a minimum (by using serial-type devices), but there are instances where large numbers of I/O pins are required. For instance, the 4 × 4 keypad requires eight lines just to decode the proper key. Yes, a two-to-four decoder could have been placed external to the MCU which would free up two additional lines, but it also would have required an external device to perform that function. The system designer must make the decision here. In this

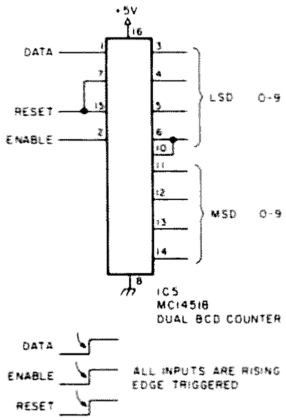


Fig. 8. MHz-counter option.

case, I chose to "multiplex" the data lines for the clock on the same I/O lines as those required for the keyboard.

The way the software works, immediately after a key is released, e.g., the "enter" key, the data direc-

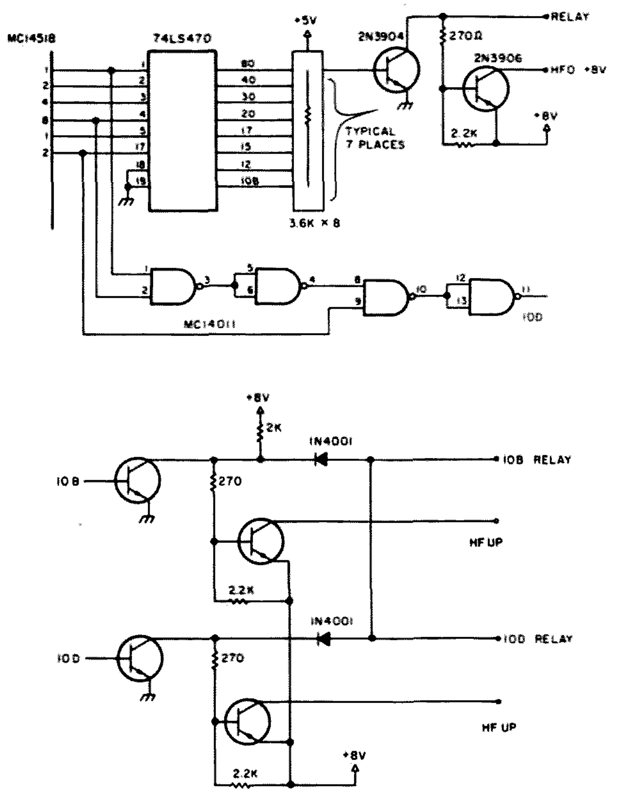


Fig. 9(a). This circuit provides automatic bandswitching for the FT-707. Alternative connections may be required for the FT-107 or other radios. Be sure to place the FT-707 bandswitch in the unused position when this hardware is connected.

ADDRESS	DATA
$03	$80
$07	$40
$10	$20
$14	$10
$18	$08
$21	$04
$24	$02
$28	$01
$29	$03

All other locations are $00.
$ denotes hexadecimal notation.

Fig. 9(b). This program must be burned into the 74LS470 PROM of bandswitching circuit.

tion registers in the MCU are set up to talk to the 6818. Data is then transferred to the 6818's RAM. As soon as the data transfer is complete, the MCU is reconfigured for inputs from the keyboard. The actual transfer time is so short (<300 μs) that no matter how hard the operator tries, he cannot hit another key before the data transfer is complete. While in the time-display mode, once every second an interrupt is generated. As soon as the MCU recognizes this interrupt, the MCU reads the time from the 6818 and displays it. As soon as that data is read, the MCU is reconfigured for a keyboard entry. The rest of the one-second period, the MCU is waiting for a button to be pushed. The amount of time required to read the time (< 50 μs) is the only time that depressing a key could possibly disturb the actual data read. But since any key depression would be greater than 20 ms, the incorrect frequency would be displayed, then immediately jump out of the time-display mode and redisplay the last frequency.

Band and Mode Switching

For the vfo to be used conveniently with a multiband transceiver, some method must be provided to tell the external PLL system which MHz segment it is on. This function is implemented as follows.

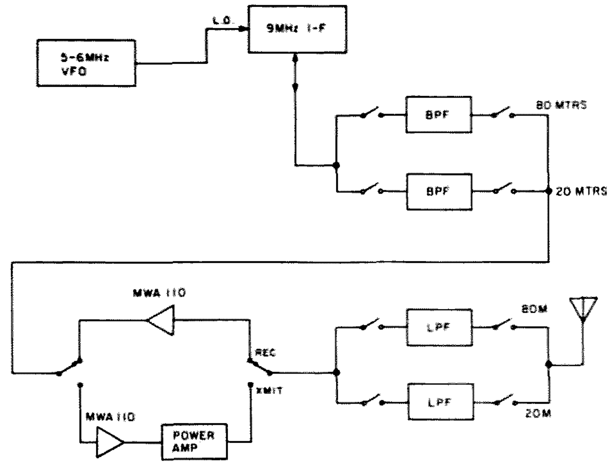


Fig. 10. Block diagram of a complete single-conversion transceiver controlled by the microprocessor vfo.

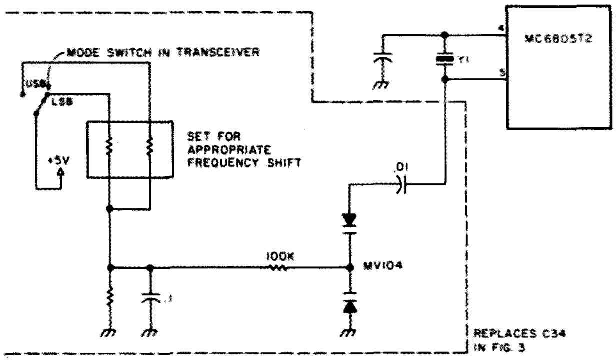


Fig. 11. Mode switching for rigs which display actual operating frequency (not carrier frequency).

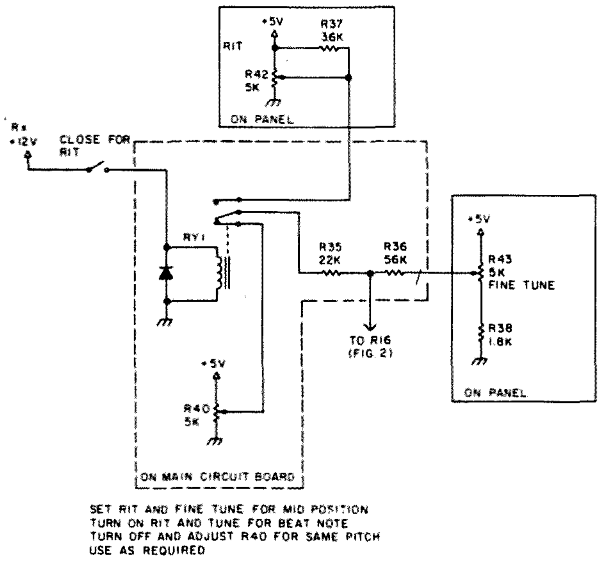


Fig. 12. Adding RIT and fine tuning to the vfo. Most of these components mount on the main circuit board.

Whenever the frequency is sent to the on-board synthesizer, the two most significant digits (MHz) are sent serially to the data pin (PC0). If operating on 5 MHz, the sequence of events is: (1) set up the 5-6-MHz synthesizer, (2) pulse the SQW pin of the 6818 (resets the external counter), (3) set the clock enable pin (allows clock line to increment counter), (4) send out five pulses (for 5 MHz), (5) clear the clock enable pin, and (6) continue with program.

The circuit for a simple decoding scheme using the MC14518 dual-BCD counter is shown in Fig. 8. One use for the outputs from the counter is to provide automatic bandswitching.

References were made earlier to bandswitching on an FT-107 or FT-707. Fig. 9(a) shows how it may be accomplished. By taking the outputs of the binary decoder of Fig. 8 and running them into a 74LS470 Programmable Read Only Memory (PROM), certain combinations of frequencies may be turned into levels which may drive circuitry to change bands. The PROM must be programmed as per Fig. 9(b). Unlike older transceivers, the FT-107 and 707 do not use a bandswitch which runs the entire depth of the rig. The actual switch is only a double-pole type which switches relays within the radio. By placing this switch in an unused position and adding appropriate drivers, the remote vfo can switch bands, too!

I originally used this vfo with a simple home-brew transceiver that operates on both 80 and 20 meters, with no external heterodyne oscillator. This single-conversion radio provides an excellent "simple" radio, with the T2 controlling everything, including the bandswitching of the filters. Fig. 10 shows a block diagram of this radio.

The vfo provides the actual frequency selection, with the display presenting the operator with the carrier frequency. If you are upgrading a standard radio such as Heath or Collins where there was an analog method of readout, there will be no problem in conversion. But if you are already using a digital readout that displays not the carrier frequency, but the actual "talk frequency," then an additional modification must be made to the system. This mod will shift the reference oscillator by 1.5 kHz, either up or

MODE (PC2,1,0)	DISPLAY	VFO FREQUENCY	PURPOSE
000	3.0000	5.0000	INVERTED 80-20M
	3.9999	5.9999	AUTO REV ON 20
	14.0000	5.9999	MHZ NOT SENT
	14.9999	5.0000	PC2 1 = 80 0 = 20
001	XX.0000	5.5000	FT107 MODE
	XX.5000	5.0000	MHZ SENT
010	XX.0000	5.9999	INVERTED
	XX.9999	5.0000	MHZ SENT
101	XX.0000	5.0000	NORMAL
	XX.9999	5.9999	MHZ SENT
110	3.0000	5.9999	80-20M
	3.9999	5.0000	AUTO REV ON 20
	14.0000	5.0000	MHZ NOT SENT
	14.9999	5.9999	PC2 1 = 80 0 = 20

Table 1. Vfo options. MCU I/O pins PC0, PC1, and PC2 are strapped to 1 (+5 V) or 0 (ground), depending on the vfo mode you select.

Parts List

Component	Value (Ω)	Quantity	Component	Value	Quantity
			Y4	18.36 or 18.86 MHz	
			RY1	Relay (RIT)	1
R1,8,14	47	3	C1,2,7,10,11,13,43,	.1 µF	17
R2,35	22k	2	44,14,15,16,18,26,		
R11,16,29	100k	3	27,45,46,49		
R4	5.6k	1	C3,C4	300 pF	2
R6	910	1	C5	200 pF	1
R7,15	680	2	C6	.47 µF	1
R9	270	1	C8	65 pF	1
R10	50k pot (small)	1	C9	91 pF	1
R12,13,15,26,	15k	7	C12,20,24,28,30	1000 pF	5
27,28,30			C17,19	82 pF	2
R17,R33	1k	2	C21	10 pF	1
R18	750	1	C22	20 pF	1
R19	68	1	C23	12 pF	1
R20	56	1	C25,31	150 pF	2
R21	82k	1	C29,32	470 pF	2
R22	39k	1	C33,47,48	1 µF	3
R23	20k	1	C34,36	10-40 var.	2
R24,31,39,	10k	12	C35	50 pF	1
44-51,3			C37	39 pF	1
R32	4.7k	1	C38	.47 µF	1
R34	200k	1	C39	*10-40 pF	1
R36	56k	1	C40	*39 pF	1
R37	3.6k	1	C41,42	2 µF	2
R38	1.8k	1	C50	10 µF	1
R40,41,42	5k pot	3	Q1	2N5484	1
	(2 panel, 1 PCB)		Q2,3,5,6	2N2222	4
R5	27k	1	Q4	2N3906	1
R43	10 meg	1	D1,4,5,6	1N914	4
R53	300	1	D2	MV104	1
R58	2.2k	1	D3	MV830	1
L1	150 µH	1	D7,9	1N4002	2
L2	1-2 µH	1	IC10	LM358	1
	(13 turns #28 ¼"		IC1	*MC6805T2 or	1
	form)			68705P3	
L3,4	6.8 µH	2	IC2	MC146818P	1
L5,6	1.8 µH	2	IC3	MC145000P	1
B1	MD108	1	IC4	GE Display	1
	double-balanced		IC5	MC14518P	1
	mixer		IC6	*MC145155P	1
Y1	4.096 MHz	1	IC7	MC7805	1
Y2	4.194 MHz	1	IC8,9	MC78L05	2
Y3	*2.048 MHz	1			

*denotes MC68705P3 option.

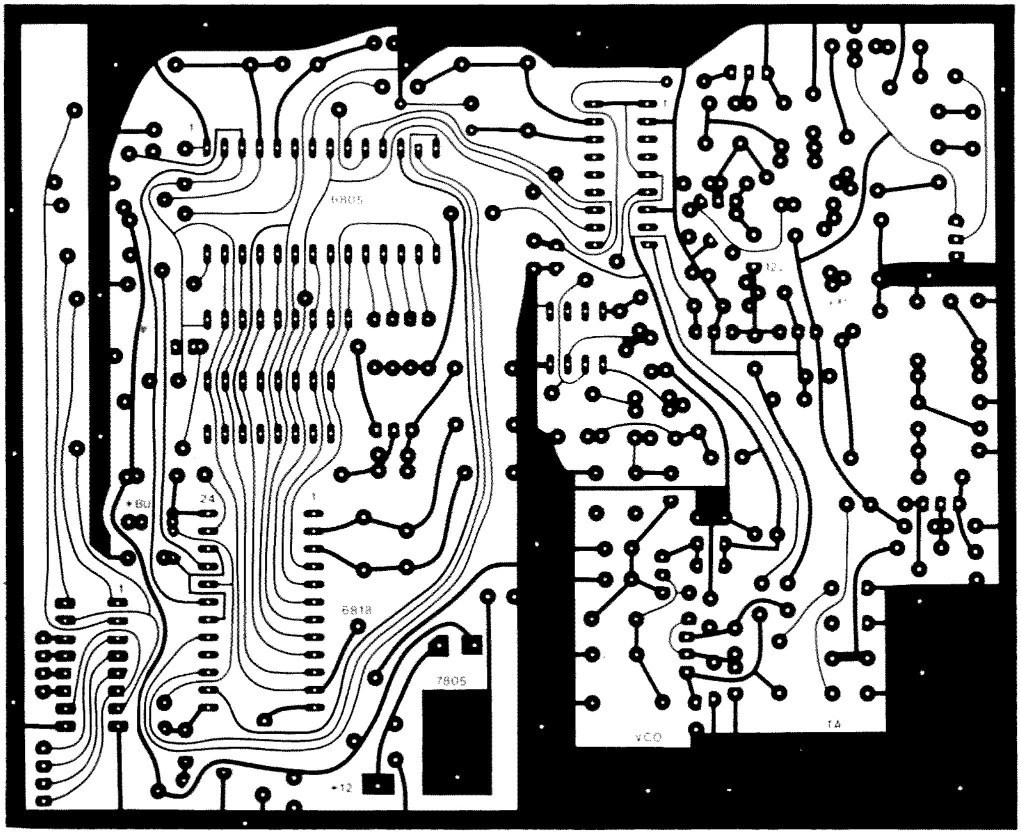


Fig. 13. Main vfo PC board (foil side).

down, depending on which sideband you are on. By tapping off the mode switch in the rig, the frequency may be shifted automatically.

Fig. 11 gives an example of how this may be accomplished. In this diagram, a voltage divider is switched, depending on what mode the radio is in. Of course, an additional position on the switch may be used for CW, AM, etc. This mod must be made if using the vfo as a companion for another digital rig which uses a 5-to-6-MHz vfo.

RIT

In almost every rig that I've owned, receiver incremental tuning (RIT) was a must for operating convenience. This vfo provides the user with not only a RIT control, but also a fine-tuning adjustment for stations between the 100-Hz resolution of the vfo. The foil pattern for all RIT components with the exception of the panel controls is on the PC board, including the relay used to switch it in and out. Fig. 12 illustrates how the RIT is implemented. (Thanks to Yaesu for their design.)

Construction and Alignment

I recommend that the vco be built first. This is the most difficult portion of the vfo, and the rest comes easily once this is completed. After the vco is built, check its frequency range by turning the slug in coil L2. It should encompass the 12.36-13.36-MHz range required. After this has been built, build the rest of the rf section (18-MHz vxo and filters). Only after you have 5 to 6 MHz coming out of the filter stage should you proceed with the digital section. Depending on which parts you are using (T2 or P3), select the appropriate jumpers and install the rest of the parts. The 6818 fre-

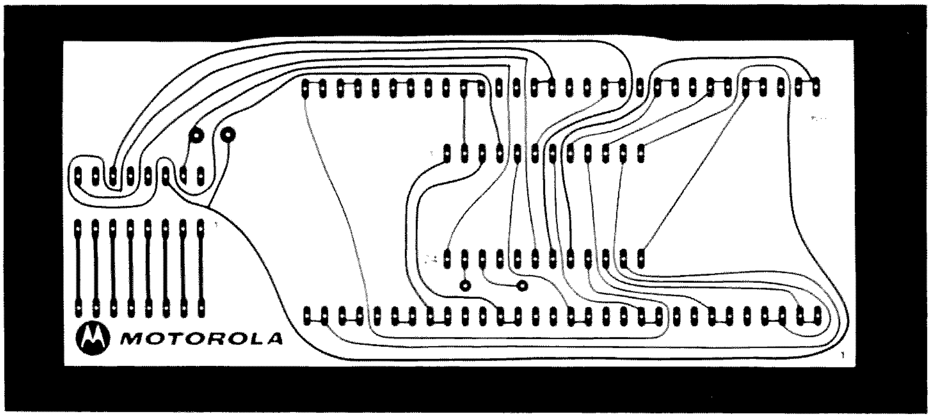


Fig. 14. Display PC board (foil side).

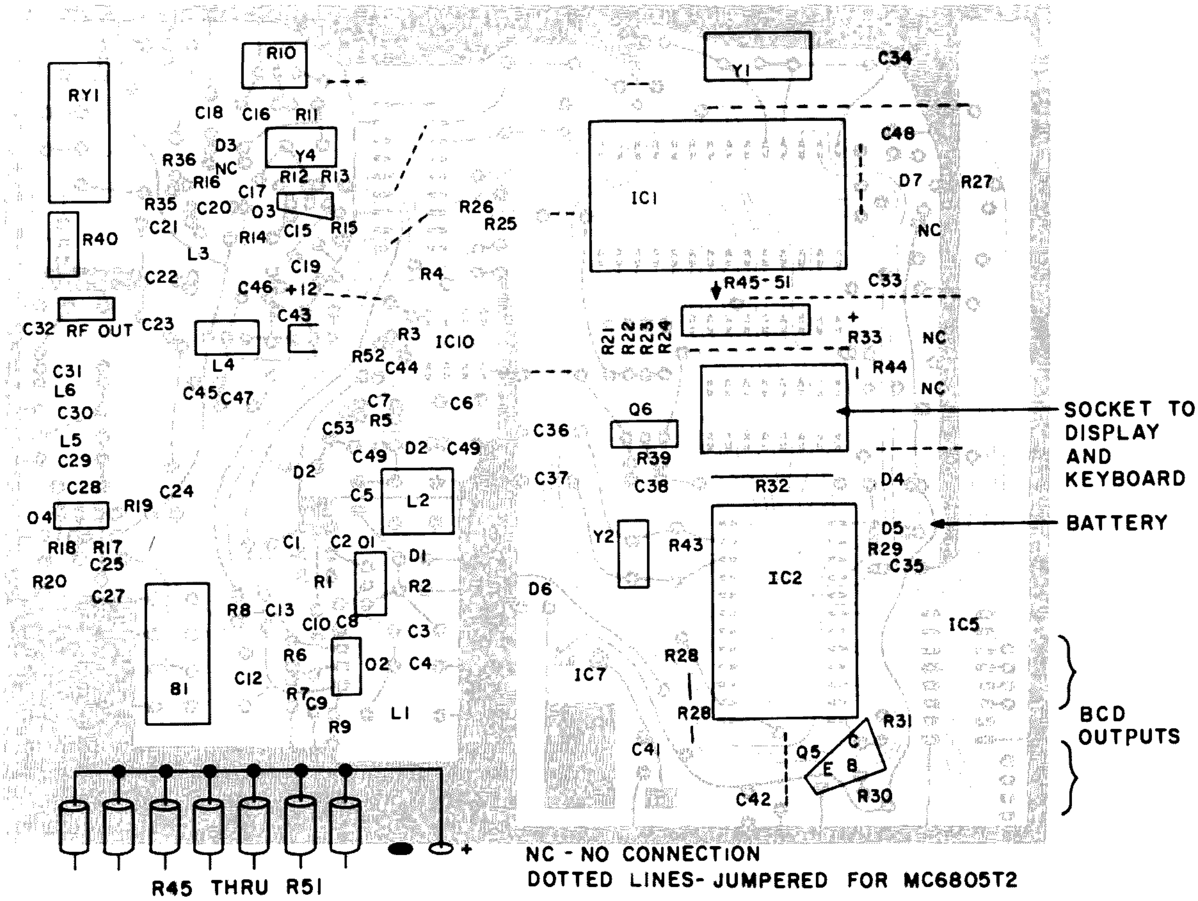


Fig. 15. Component placement, main board.

quency may be adjusted by placing a counter on pin 21. Trimmer C36 should be adjusted to read 4.194308 MHz. If you cannot bring it exactly on frequency, some adjustment of fixed capacitor C37 may be required.

If you are using the P3, the frequency of the MC145155 may be observed on pin 15 of the part. Adjust C39 for 2.048 MHz. If using the T2, use a low-capacitance probe on pin 5 of the MCU and adjust C34 for 4.096 MHz. If, upon power-up, the unit appears dead, it is time to borrow an oscilloscope to do some checking. First, check the jumpers and power supplies. Next, check to see that the oscillators are functioning properly.

If the unit seems to operate properly but the vco will not track, be sure that the loop filter is properly built and that there is a feedback frequency back to the PLL. Also, check for the obvious solder short.

Figs. 13 and 15 are the PC layouts for the vfo and display, respectively. Figs. 14 and 16 show component placement.

Table 1 lists the available modes of the vfo system. The modes are selected by strapping I/O pins PC0, PC1, and PC2 to either +5 V or ground through 15k resis-

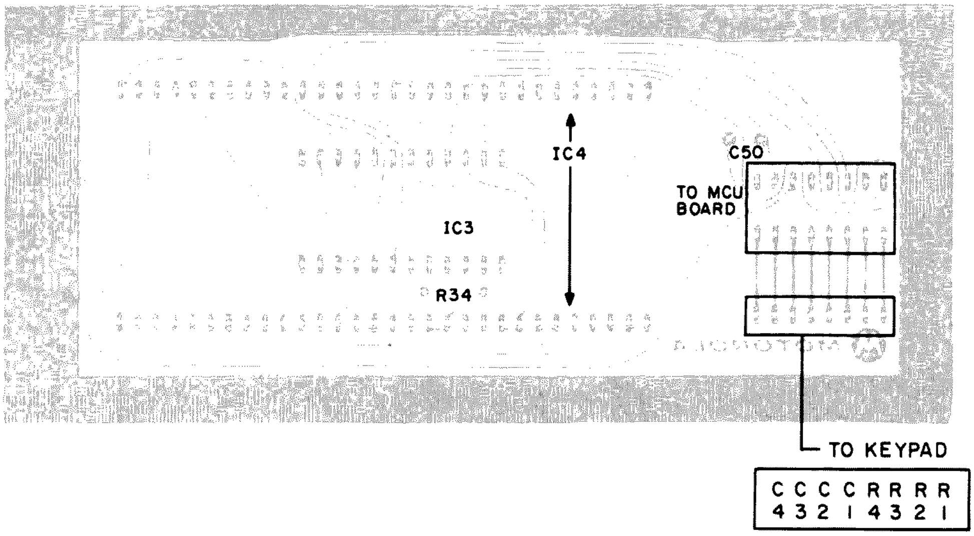
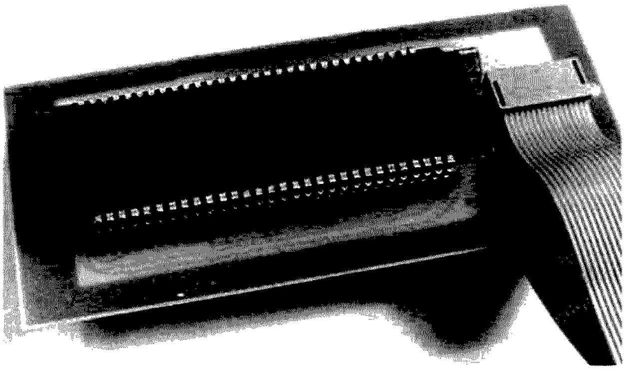
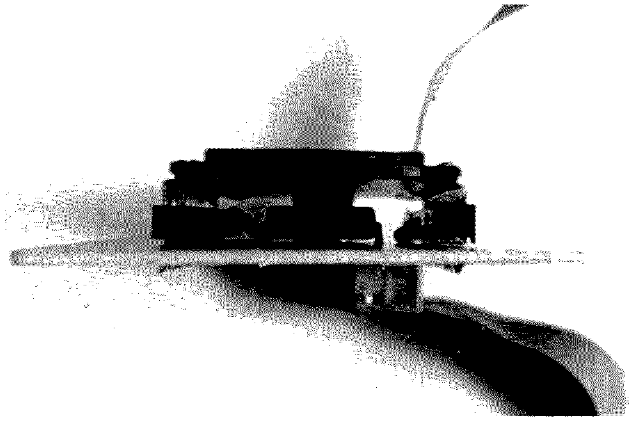


Fig. 16. Component placement, display board. Driver chip fits under display unit, on the same side of the board. Display unit is elevated above the board by segments of high-profile IC sockets (see photos).



Display board. The liquid crystal display (LCD) unit plugs into a home-brew socket composed of pieces of two 40-pin IC sockets.



Display board. This view shows how the display driver IC mounts beneath the LCD unit.

tors. In the first column of the table, a 0 indicates the pin is connected to ground, while a 1 means the pin is connected to +5 V. The table shows the available modes vs. the frequencies produced. Also included are the purposes behind each mode. The mode is read at reset time on PC0, PC1, and PC2.

Getting the Parts

Approximate costs of the high-value items of the project are:

- MC6805T2L2—$12.00-15.00
- MC68705P3—$50.00 (not needed if the T2 is used)
- MC145155—$7.32 (not needed if the T2 is used)
- MC146818—$10.00
- MC145000—$12.49
- 8-digit LCD—$26.40

The MC6805T2 containing the program used for this project is an evaluation part under the number MC6805T2L2 (ceramic case) and is available from any Motorola distributor, as is the MC68705P3, the alternative MPU.

The liquid crystal display (GE part LXD69D7R09) is available from any GE distributor (Hamilton Avnet, etc.).

My heartiest thanks go to Helge Granberg and Mike Pendley, who provided me with some necessary rf savvy, and Ulrich Rohde, who gave me some insights into PLL system design. ■

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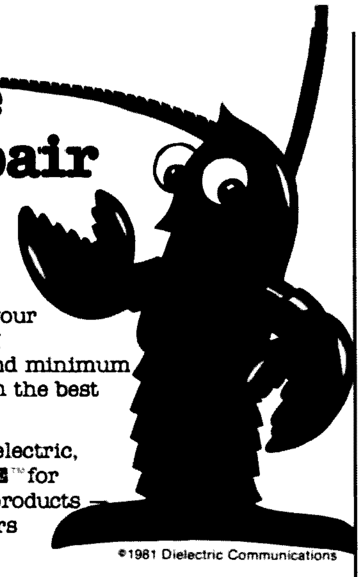

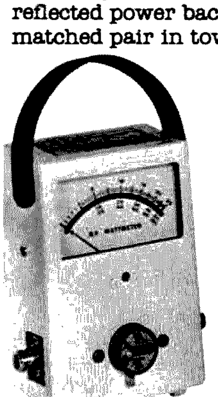

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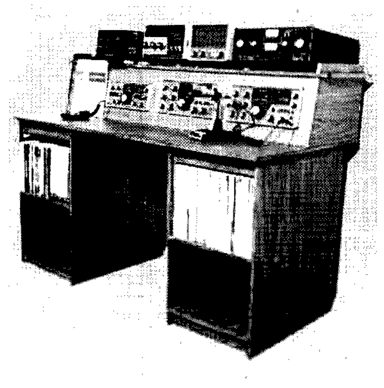

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Surviving the Unthinkable

—part II: some practical ideas

In part I, I talked about the *idea* of emergency communications after a nuclear attack and the benefits the Amateur Service might provide. In this part, we'll talk about specific steps that each of us can take. First, though, let's set the stage:

Imagine this situation for a moment: The most incompetent of operators walked into your shack and for a fraction of an instant connected your receiver's antenna terminals to a high-voltage distribution line. The result was a 40-kV, 1,000-Amp shock to the input of your receiver. There wouldn't be very much left of your sensitive input circuits, to say the least.

This sounds like an impossible situation. I only wish that it were truly impossible. But in today's crisis-oriented world, the situation is indeed within the realm of possibility. The 40-kV shock is what civil-defense experts say would be the result of a nuclear blast in the vicinity of most any piece of unshielded wire, including telephone wires, power lines, antennas, and feedlines. The phenomenon is commonly referred to as a nuclear electromagnetic pulse (EMP or NEMP).

This kind of pulse is so extreme in amplitude that many normal lightning protectors are useless. For example, a typical lightning pulse has about a 100-microsecond duration, with a 5-microsecond rise to its peak. A high-altitude EMP pulse can be expected to have a 1-microsecond duration and a 10-nanosecond rise to its peak. That's not enough time for many common lightning arrestors to work.

In the following pages we'll talk about some of the EMP protective measures which should be taken on your equipment. Without protection, sensitive semiconductors would be most likely to fail and put you out of business when your services may be needed most.

But, first, why should we even be concerned about protection? After all, any nuclear exchange seems to be so outrageously incompetent on the part of world leaders that it seems that it never could happen. Unfortunately, however, we've seen in the last few years that many improbable things such as revolutions, hostage taking, etc., have actually occurred.

Even though we all hope and pray that a nuclear exchange does not occur, let us not underestimate the devastating and paralyzing effects of such an exchange. Simply imagine, for a moment, a world with *hundreds of millions* of US and Russian citizens killed and *tens of millions* more severely and untreatably burned, near death, and starving. Major cities, with their sophisticated hospitals, police, telephone communication systems, radio and television stations, transportation, food distribution networks, financial centers, and manufacturing centers all eliminated—gone—not much usable left, and most likely too radioactive to approach for many years to

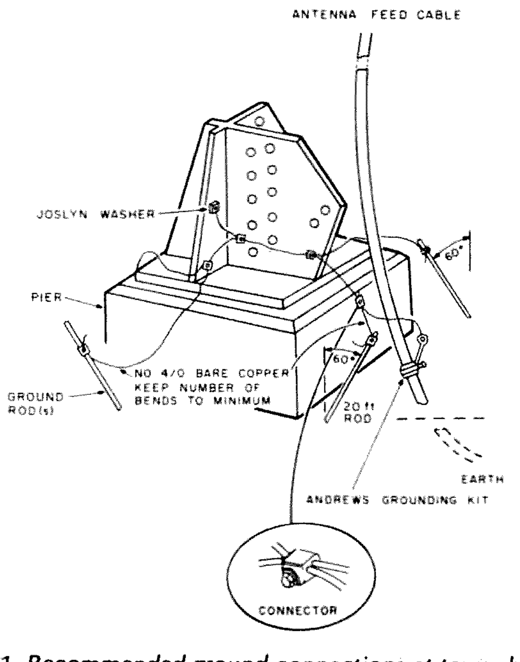

Fig. 1. Recommended ground connections at tower base.

come. The situation might be reminiscent of the Cambodian experience of recent years, where a ruthless and irresponsible leadership evacuated the cities and forced an entire country into an unnecessary disaster. Imagine that situation in your community, among your friends—perhaps worldwide!

However, even in the worst of disasters, there will be some survivors. If not us, then our friends or relatives. Perhaps our children or grandchildren will be among those fortunate survivors. There also will be some amateur radio operators. Perhaps the best thing that we can do for these people faced with a completely unknown and hostile environment is to ensure that they have every possible assistance available to help them through the crisis.

In communications, that assistance means that in a world where the established public system is no longer available, the technical preparations of amateur radio operators may make the difference between life and death for countless hundreds of thousands. It could be the final foothold in their struggle for survival. After all, assistance during disasters is one of our key elements, and a justification for an Amateur Radio Service. Only amateur radio operators can supply an organized communication system from almost every community in this country. Only amateur radio operators can supply this system with a substantial portion of the surviving equipment easily made operational after the shock of a nuclear explosion. Citizens Band equipment for the most part would be rendered totally useless by its unprotected reliance on semiconductors and its tendency for

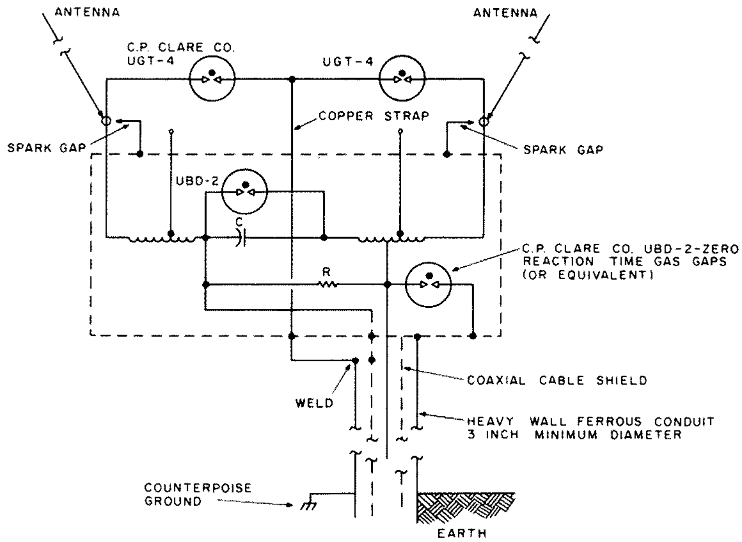

Fig. 2. Suggested use of gas gaps in an antenna balun. Note that this approach uses a thick-wall conduit around the coax.

total disorganization even in times when there is no crisis.

The job of amateur radio equipment protection is easy once we realize that it does not need to be difficult or complex. Most any technical or non-technical operator can accomplish *some* EMP protection on short notice, with a very small outlay of money. The objective is to safely bypass your equipment and any incoming connections when they are presented with an EMP signal composed of 40 to 50 kV and current in the order of 1,000 Amperes.

It is interesting to note that much of the EMP protective equipment available today has been designed since our country stopped testing nuclear weapons. As a result, none of it has received the only true test of reliability—on-the-job testing—although EMP simulators are used.

Because of the lack of widespread testing capabilities, the only really proven method of protection is also the simplest. Under this approach, all equipment to be protected should be disconnected from all external wires and

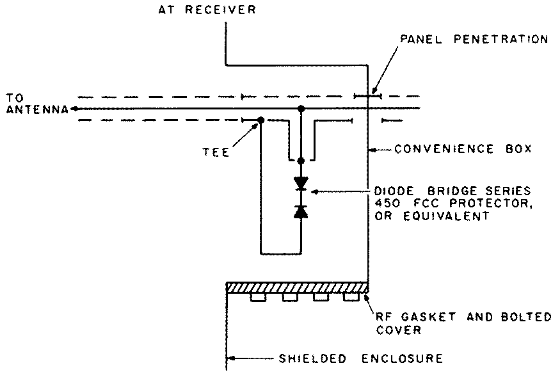

Fig. 3. Coaxial tee protectors used in a receiver circuit.

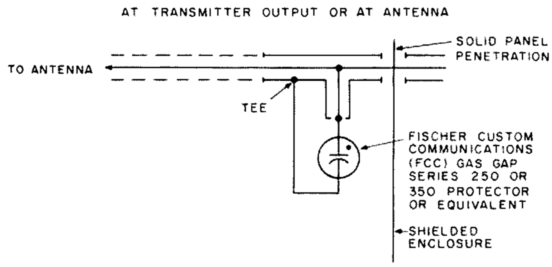

Fig. 4. Coaxial tee protectors shown in a transmitter circuit.

stored in a thoroughly sealed and shielded box. The box should have no holes where any kind of energy can get in and should have a skin made of 18- to 26-gauge metal to provide magnetic shielding for the equipment inside.

Since the civil-defense planners expect to have Americans moved to a safe location 30 to 200 miles from their community, depending on the nature of threat to that community, the equipment should likewise be moved to a location 30 to 200 miles from the community.

Keep in mind when storing your equipment that power supplies also should be shielded and stored with

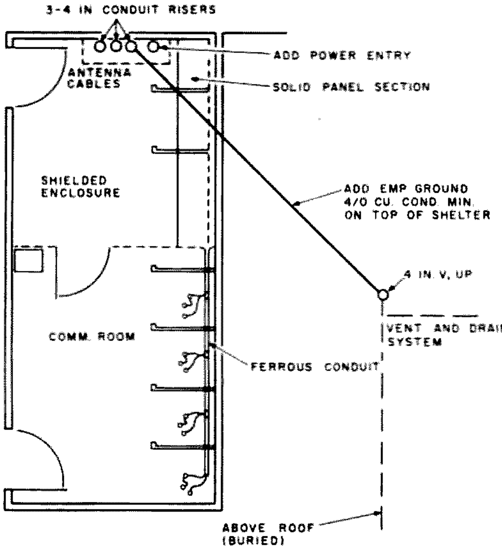

Fig. 5. Suggested layout for communications room with remote operation of equipment.

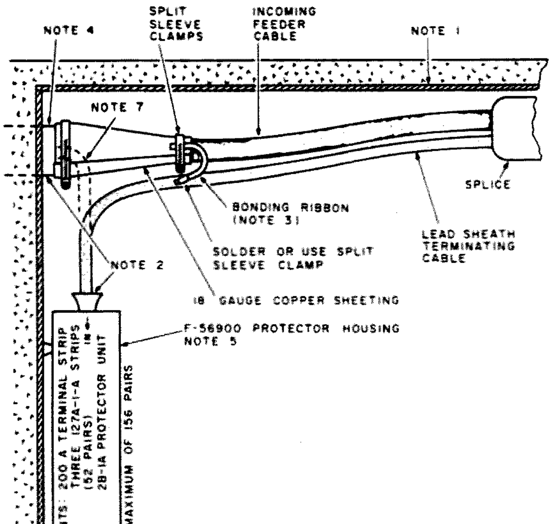

Fig. 6. This is one recommended method of protecting a telephone cable system against EMP transients. Note the heavy emphasis on shielding. The numbered notes refer to detailed construction specifications.

your equipment because they are just as susceptible to an EMP transient signal as is your sensitive transmitting and receiving equipment. A publicly-released 1970 Department of Defense publication suggests that if equipment must be used during a threat of nuclear attack, at least one set of equipment (and likely more) should be held in reserve in the event of any equipment failure. In the ideal case, ham operators should have a reserve available due to equipment failure caused by every succeeding attack.

Good grounds are very important to EMP protection, and antennas should be well grounded. But a smart operator would keep a longwire and tuner stored as if to be used for Field Day for, in any emergency, the antennas can be expected to take the brunt of the effects and may need to be replaced in the fastest time possible.

The Department of Defense publication *EMP Protective Systems* suggests several approaches which should be used if you're going to shut down for a while in anticipation of an attack. First, you should open the master power switch at your service entrance. Second, all circuit breakers should be opened and all critical equipment should be turned off or disconnected.

When the equipment and power are to be restored, all circuits should be checked for arc-overs or damage before power is restored. Be sure to disconnect telephone and cable television connections, because the advice indicates that there

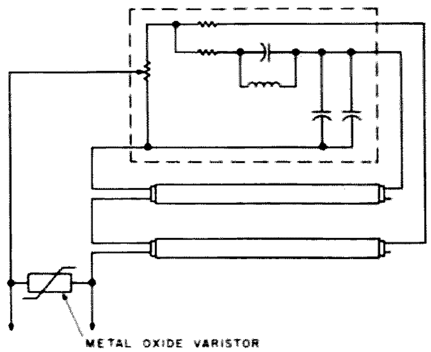

Fig. 7. This is a typical varistor installation applied to a fluorescent lighting circuit.

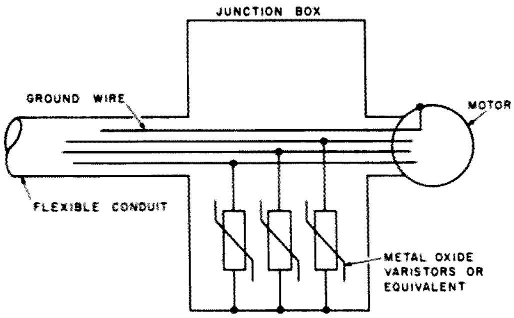

Fig. 8. This is a suggested circuit for EMP protection of a 3-phase, 4-wire motor using metal-oxide varistors (MOVs) connected between each hot wire and ground.

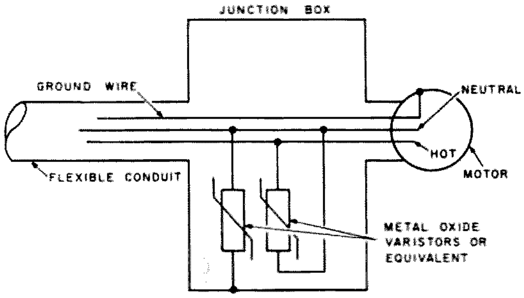

Fig. 9. Single-phase motor protection using MOVs between hot wires and ground.

could be a problem with *any* wire coming into your home. Since the EMP energy in long overhead wires can be extremely hazardous, be sure people stay away from these wires during a time of possible attack.

If you must have some radio equipment operating, dig out your old tube-type equipment and use it. Tubes are much less sensitive to high-voltage shocks and are more likely to recover. It is felt that less protective shielding is necessary for broadcast receivers with loopstick antennas or receivers with short antennas, including two-meter equipment. Again, however, because there are so many unknowns, a wise operator would most likely consider any equipment in full use to be vulnerable.

More advanced EMP protective measures which allow more operating versatility also have been published under the name of the Defense Civil Preparedness Agency and may be obtained from the Federal Emergency Management Agency in Washington, DC (ask for publication TR-61-B). These approaches to the problem center around the use of gas-gap arrestors, metal-oxide varistors (MOVs), coaxial tee protectors for antenna cables, and improved grounding. Some of their suggestions are described here, so you can start on your protection right away. The approach requires some expense and would be used if you would anticipate operating during a nuclear threat.

Improved grounding of a tower is extremely important for supplying a low-impedance path to ground for EMP current. The suggested way to accomplish this is shown in Fig. 1. The tower should be connected to the ground rods using 4/0 wire.

An alternative is to install 20 radials about 12 to 18 inches below the surface, using ½-inch copper tubing. The approach could get very expensive at today's copper prices but would provide an undisputably super ground for your vertical. Be sure to connect the outside of your antenna feed cable shields to the ground. Any control cables going up the tower should be shielded in threaded conduit so there is a perfect conductive shield all along the line.

A particularly sensitive part of an antenna circuit is a balun at the antenna feedpoint. The best way to protect a balun is to provide "zero reaction time" gas-gap arrestors in parallel with all balun capacitors and inductors. Be sure to have the breakdown voltage of the gas gap higher than that which you would expect under normal operations, even under unusually high swr conditions. Gaps can have breakdown voltages ranging from 220 volts to 30 kV and have current ratings ranging from 3,000 Amps on up.

The amount of time that any one gap arcs over is a factor to be considered when selecting the gap. Almost any gap can sustain a large number of low-current arc-overs, but only a few very-large-current arc-overs during its life. The specifications for each gap should be consulted if it is also to handle lightning-arresting chores in addition to EMP protection. Also, most gaps capable of EMP protection are labeled as such.

The characteristic capacitance of each gap is of

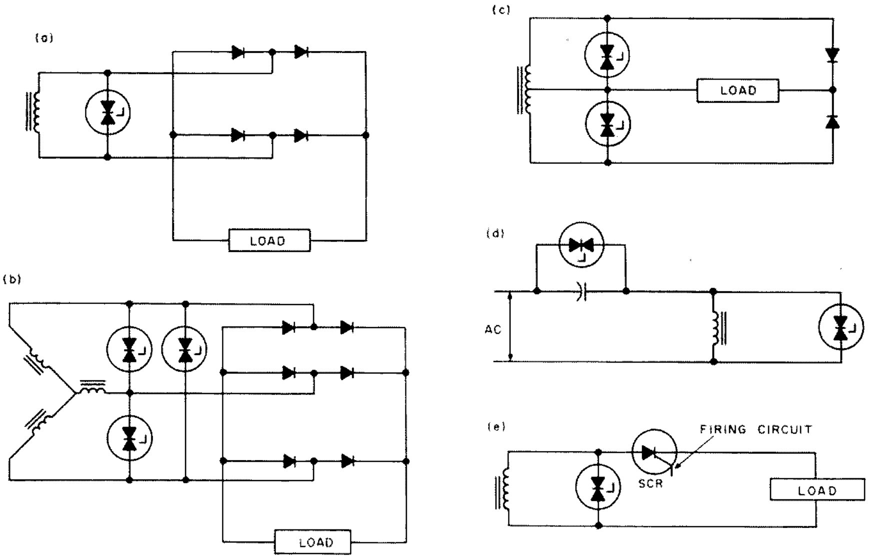

Fig. 10. Various EMP protective circuits for several typical circuits.

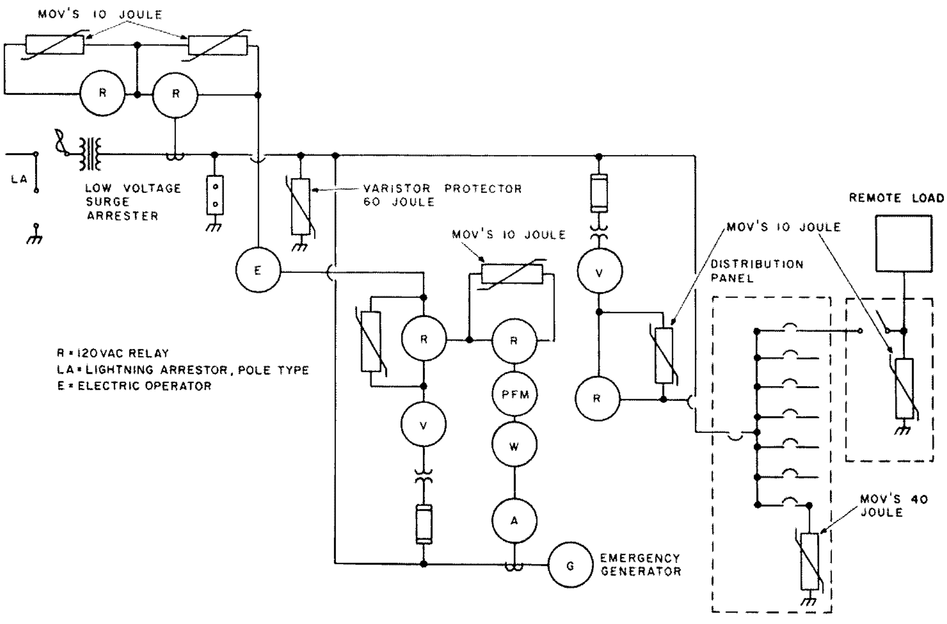

Fig. 11. Full-blown EMP protection for supplying power to communications equipment.

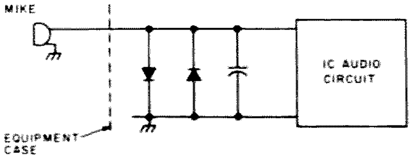

Fig. 12. Switching diodes may be used to protect very short wires. Use 1N3653s and a 0.1-μF, 500-volt capacitor.

considerable importance in rf circuits since the interelectrode capacitance between gap electrodes can cause additional capacitance to be put into the circuit along with the gas gap. This capacitance can be on the order of 2 to 15 pF or more, depending on the type of gap. The capacitance can be reduced by connecting two gaps in series. If you use that approach, be sure to put a 1-megohm or higher resistor (about 1 Watt) across each gap to equalize the voltage between gaps. Keep in mind, too, that connecting two gaps in series roughly doubles their breakdown voltage. An example of the use of gas gaps in an antenna balun is shown in Fig. 2.

At the transmitter or receiver, you may use a gas gap or tee protector as shown in Fig. 3. The diode shown here is a silicon type. While this diode has a fast reaction time, it may not be able to sustain the needed current, and should be preceded by a gas gap at a point closer to the antenna. Fig. 4 shows a gas gap connected in a transmitter circuit.

If you want to go first class and prepare the entire shack (Fig. 5), you could be in for a very expensive project, which may not be necessary if you can shut down your equipment as discussed above. However, if you wish to take that step, the FEMA recommends that the shack should be *completely encased* in 18- to 26-gauge galvanized sheet metal! To provide complete protection, the treatment includes the door and ventilation facilities. The sheet metal should be folded at the seams and soldered, with a strip of tinned-metal tape covering the seam.

Telephone landlines should be brought into the shack via 50 to 300 feet of conductive conduit which is welded to the enclosure at the point of entry. The lines should be terminated in gas gaps, metal-oxide varistors, or both. Fig. 6 shows an example. Even your lighting system should have MOV protection as shown in Fig. 7.

Ac power supply lines should have MOVs at all critical points. FEMA recommends that MOV ratings should exceed the stored inductive energy of the preceding transformer and also should exceed the no-load transformer current. Typical varistors have ratings of 40 joules (some are in the range of 10 to 200 joules) and should be installed at 40 joules per phase of the ac line. Four 10-joule varistors connected in parallel will provide the needed 40-joule protection. Electrical distribution boxes and control boxes, of course, should be thoroughly shielded. FEMA recommends that doors and openings should be fitted with rf-shielding gaskets and conductive epoxy.

Don't forget the ventilation system, where all motor wires and switches should be thoroughly shielded and protected with MOVs. Some additional circuit protection approaches may be seen in Figs. 8 through 12.

Of particular importance is the emergency generator to be used. All important wiring should have MOV protection. Shielded conductors should be used for best results and the shields should be grounded. ■

EMP Protection Equipment Sources

Some EMP protective devices are not easily obtained. I have found that even a local distributor cannot always obtain information about them. Following is an updated list of sources. Those with asterisks (*) have expressed their interest in selling the equipment by sending me information when I specifically requested information about EMP protection.

*C. P. Clare Co. 3101 West Pratt Avenue Chicago IL 60645	Gas gaps and other transient protectors
Dale Electronics, Inc. Box 609 Columbus NE 68601	Gas gaps and other transient protectors
*Emerson and Cuming, Inc. 869 Washington Street Canton MA 02021	Conductive adhesives Rf gaskets Rf shielding
*Fischer Custom Communications Box 581 Manhattan Beach CA 90266	Coaxial tee protectors
General Electric Company Electronic Comp. Sales Operation 1 River Road Schenectady NY 12306	Metal-oxide varistors (MOVs)
General Semiconductor Industries 2001 W. Tenth Place Tempe AZ 85281	Gas gaps and other transient protectors
*Joslyn Electronics Systems 6868 Cortona Drive Goleta CA 93017	Gas gaps and other transient suppressors
Lectro Magnetics 6056 W. Jefferson Blvd. Los Angeles CA 90016	Rf shields
E. A. Lindgren and Associates 4515 N. Ravenswood Avenue Chicago IL 60640	Rf shields
Ray Proof Corporation Keeler Avenue Norwalk CT 06856	Rf shields
*Shielding Technology, Inc. (Division of Chomerics) 970 New Durham Road Edison NJ 08816	Conductive adhesives
Technical Wire Products 129 Dermody Street Cranford NJ 07016	Rf gaskets and shielding
*Technit (EMI Shielding Division) 320 North Nopal Street Santa Barbara CA 93103	Rf gaskets and shielding
Topatron, Inc. Box 967 Costa Mesa CA 92627	Rf gaskets and shielding
Transtector Systems 532 Monterey Pass Road Monterey Park CA 91754	Transient suppressors

Acknowledgement
The basis for Figs. 1 through 6 and 8 through 11 is *EMP Protective Measures*, Defense Civil Preparedness Agency, 1976.

Bob Ghormley K0BV
5800 Jones Pl. NW
Albuquerque NM 87120

A Split Personality for the KDK FM2015R

A simple modification to your KDK FM2015R will give you the capability to receive on one frequency stored in memory and transmit on another. This modification gives you the newer FM2016's capability to operate with nonstandard offsets without an additional crystal. It requires two diodes, a piece of wire, no holes, and less than half an hour. The rig may easily be returned to original configuration whenever desired.

A different form of this mod was described in some Amateur-Wholesale Electronics notes concerning MARS-CAP modification, so I can't take credit for the original idea. I'll first describe how the modification functions, then go through a step-by-step modification procedure.

The resulting front-panel performance is as follows: Select Mode A. With the memory-select switch at OFF, you have simplex operation on the dialed-in and displayed frequency. Selecting memory position 2 will allow you to receive on the frequency stored there, which is displayed as usual. When you transmit, however, the memory internally shifts to the frequency stored in channel 1. This frequency is displayed while transmitting, and the display shifts back to your channel 2 receive frequency when the mic button is released.

Channels 3 and 4 work the same, with channel 4 functioning as the receive channel, switching automatically to the frequency stored in channel 3 on transmit. If either channel 1 or 3 is selected, simplex operation on those channels is the result. All that for only two diodes!

Here's how it works: On transmit in the unmodified rig, a transmit oscillator is diode-switched on by +9 volts from the front panel MODE switch. We locate the wire which runs to the "A" oscillator position (which has no crystal installed) and run switching diodes from there to two places.

The first diode goes to the simplex crystal position, activating it on transmit. The second diode goes to one of the two memory-select lines (A0 and A1) which select the memory channel. In an unmodified rig, the same memory frequency is used on both receive and transmit. If you trace out the schematic,

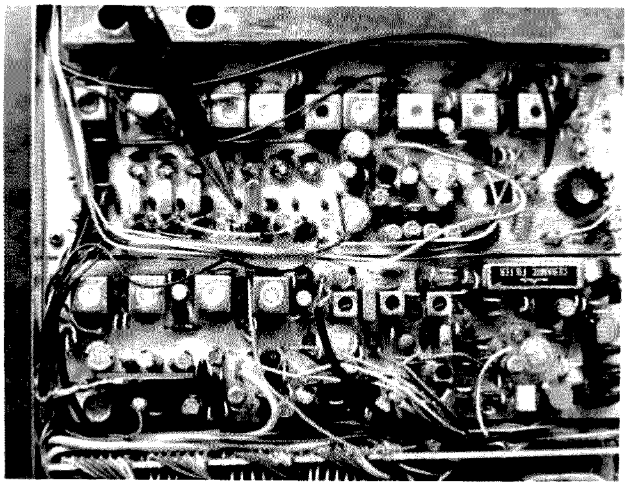
Photo A.

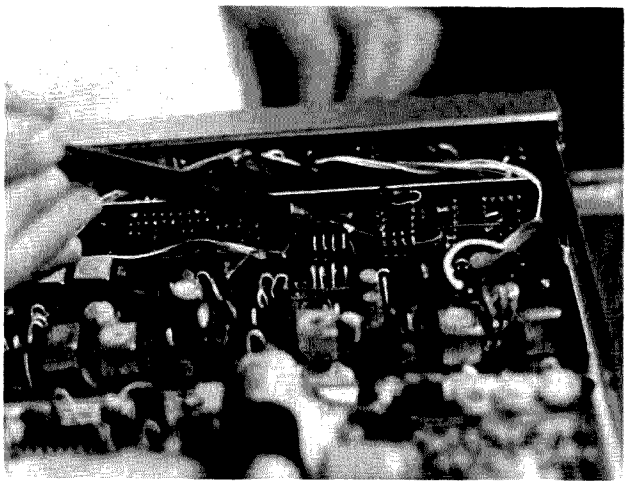
Photo B.

you will see that in the original configuration when memory position 2 is front-panel selected, +9 volts is routed through this memory switch to memory-select line A1. Or, if memory position 3 is selected, AØ is taken high. Memory position 1 requires both AØ and A1 to be high, and position 4 requires neither to be high. If we modify things to make AØ high on transmit only, then memory position 4 on receive becomes 3 on transmit, and 2 becomes 1 on transmit. This switching is done with diodes to avoid interfering with other functions.

To perform this mod, remove both top and bottom covers from the rig. With the rig right side up, locate the three crystals on the transmitter board. (See Photo A and ignore the fourth crystal which I installed for another offset.) A terminal post corresponds to each crystal position. A yellow wire is connected to the first unused crystal position, which is the fourth one in from the outside edge of the board. The pencil in the photo is touching this terminal.

Note that this wire is connected to the "A" MODE switch position and is switched to +9 volts on transmit. Remove the wire from this terminal post. You will run two diodes from this yellow wire, and you will need to mechanically secure this junction somehow. I slipped a piece of spaghetti over the terminal and tied the wire/diodes to it. However you do it, the first diode is soldered from the yellow wire to the first crystal position's terminal (the one with the brown wire). The diode points at the brown wire (cathode to brown wire) and will activate the simplex oscillator on transmit.

The second diode's anode is also soldered to the yellow wire. At this point, the yellow wire should form a "flying tie point" with the two diode anodes. Attach the cathode (point) of the second diode to a length of hookup wire. Route the free end of the wire toward the front of the radio to the control board and connect it to the AØ pad. This control board is accessible from the bottom of the radio and is located near the front panel. See Photo B. The pencil points to pad AØ. The wire attached to the pad is the one I added for this mod.

The AØ and A1 pads are designated as such on the component side of the board and have white/brown (AØ) and white/black (A1) wires attached to them on the component side. This completes the modification.

Verify that the rig will operate now as described earlier. This mod is totally "safe" in that the rig can't be harmed by incorrect front-panel switch settings. MODE switch positions B and C are still available for nonstandard offset crystals if desired. The rig's operation in all other respects is unaffected.

The only problem I encountered was that the simplex transmit oscillator didn't function until the yellow wire and diodes were isolated from the fourth oscillator terminal as I have described. If you feel like experimenting, leave the yellow wire connected and solder the diodes directly to the terminal. If it works (if the transmitter puts out power), then you win. If not, then isolate the wire/diodes as I described. Please send an SASE if you have any questions.■

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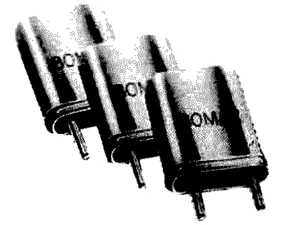

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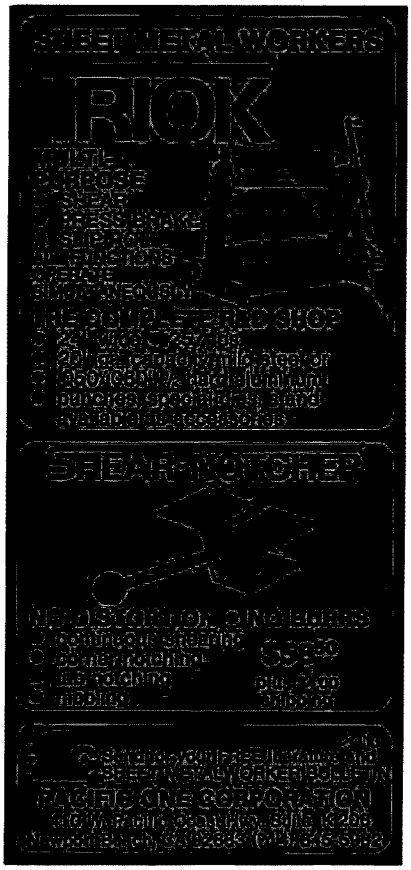

Building for Beginners

—happiness is a hot soldering iron

Paul M. Danzer N1II
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I have authored several short construction articles in the past year or two and each time their publication was followed by a flurry of letters asking for help in selecting parts and building the circuit. This mail suggests that a number of hams without very much electronic construction experience would still like to home-brew their own.

For this reason, I have put together a set of suggestions and hints which answer the most commonly asked questions. The next time you see a circuit or gadget described in *73* or elsewhere, don't be shy—go ahead and build it! You'll be delighted with the results.

Where Can I Get the Parts?

The most critical part of building anything these days is obtaining the parts. Years ago, the corner radio store carried almost anything you wanted, and if you lived in a metropolitan area you could always go down to "radio row" where there was a cluster of such stores. Today, your best bet is either the mail-order ads in the back of this magazine or the Radio Shack chain of stores. Radio Shack carries a line of the most commonly used parts and has stores scattered throughout the country.

The mail-order advertisers in the back of this magazine usually list common parts and prices for immediate order. Most of them offer catalogs, either free or for the postage, and are geared up to ship your order within a day or two after receipt. They have been advertising for many years, and the acceptance of their ads by *73* on a continuing basis shows that they deal fairly with their customers.

Try to take advantage of the "two-for" offers. Even if you have no immediate use for the extra parts, keep them around and you will probably find a use for them in some future construction project.

Resistors and Capacitors

Unless the magazine article states otherwise, use half-Watt resistors. They are most commonly available, and if a higher wattage is needed, the article will say so. If you are squeezed for space, quarter-Watt units can be used—again, as long as the article says nothing to the contrary.

Don't worry about the seemingly oddball values specified. Resistors generally come with 20%, 10%, and 5% tolerances. Using 10k Ohms as an example, Fig. 1 shows the relationship between the standard values and these tolerances. Today, most people use 10% values primarily because they are the most commonly available. If the

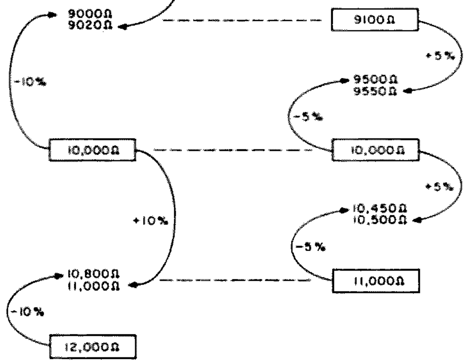


Fig. 1. Standard resistor values. Those in boxes are standard commercially-available resistors.

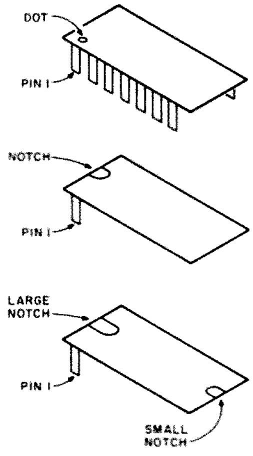


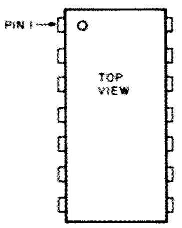
Fig. 2. IC pin locations.

article does not say anything else, you might stick to 10%. You can always use a resistor with a better tolerance (10% instead of 20%, or 5% instead of 10%). If you need 5% and can find only 10%, buy a handful of 10% resistors and check them with an ohmmeter to select one that falls within ±5% of the value required.

Capacitors have both a value and a voltage rating. You can always use a cap that has a voltage rating higher than the amount needed. For most capacitors, you must stick to the value needed but you can always use the larger-than-specified electrolytic cap when it is used for bypassing or filtering a power supply voltage. Just be careful to wire it in with the polarity shown in the schematic.

Transistors and FETs

Generally, you will have to stick to the type specified in the article. Substitutes can be used and you can pick a substitute by looking at the substitution guide printed by a number of suppliers and distributors. Radio Shack, GE, and Motorola all have hobby lines of transistors and substitution guides where you can look up the device you want; the guide will give you their substitute number. When you do substitute, be careful of the connections. Often a substitute will be very close to the original part electrically but will have a different mechanical package and/or lead arrangement.



Integrated Circuits

Let's assume that the circuit you are building uses a very common amplifier known as the 741. There are perhaps twenty versions of this amplifier, with twenty different part numbers. Each of the part numbers includes the digits 741, with the rest of the digits telling you the temperature range and mechanical package. For most uses we don't have to be concerned about the temperature range, but the pin numbers for connecting to the amplifier are very much of interest. Compare the pin numbers of the amplifier as shown in the schematic with the pin numbers of the actual part you buy.

Occasionally, the article will specify an amplifier such as the 741 and show it as a single amplifier in an 8-pin package. You might be able to obtain only a dual 741 or two 741 amplifiers in a 14-pin package. This is perfectly OK; just ignore the second amplifier.

Integrated circuits are available most commonly in "in-line" packages having 8, 14, or 16 pins. A round dot usually marks pin 1. Sometimes a notch tells you where pin 1 is, and occasionally you have to cope with a dot and two notches. As Fig. 2 shows, the dot takes precedence over the notch, and if there is a notch at both ends of the package, the larger notch tells you where pin 1 is.

Unlike tubes or transistors, the manufacturer's data sheets usually picture integrated circuits from the top. Therefore, when you are wiring them from the underside, remember that pin 1 is now on the other side of the package as seen from the bottom of the circuit board (Fig. 3).

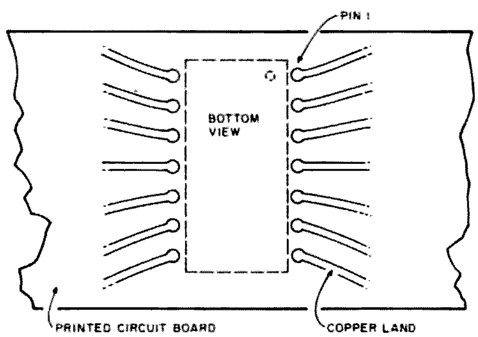


Fig. 3. Pin 1 transposition.

Diodes

Power-supply-type diodes have both a current rating and a voltage rating. You can substitute any diode which has a rating equal to or greater than the original numbers. Small signal diodes used as switches usually can be substituted for at will. Most ham circuits use a maximum of 12 volts (sometimes labeled 13.6 volts if the equipment is for mobile use). Therefore, if the circuit calls for a small signal silicon diode, almost any other silicon diode will do. Fig. 4 shows the most common markings of the diode package.

Zener diodes, used in voltage regulators, have both a voltage rating and a power rating. You must use the voltage rating called for, but you can always use a higher-power-rated diode.

Power Supply Connections

Fig. 5 shows a simple 2-transistor amplifier. With today's solid-state circuits, usually only one power-supply voltage is used and, as shown in the figure, you simply tie the identically-marked points together and connect them to the voltage required. If the schematic does not show differently, the power-supply return lead (in this case the minus 9-volt lead) is tied back to all of the ground terminals.

Jacks

Here you can substitute at will. Just remember that the most commonly used jacks have one side exposed and will connect to the chassis (ground) if they are not insulated by wash-

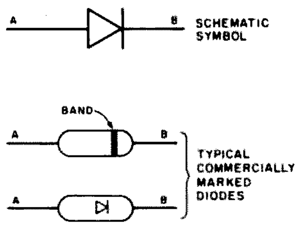


Fig. 4. Typical diode markings.

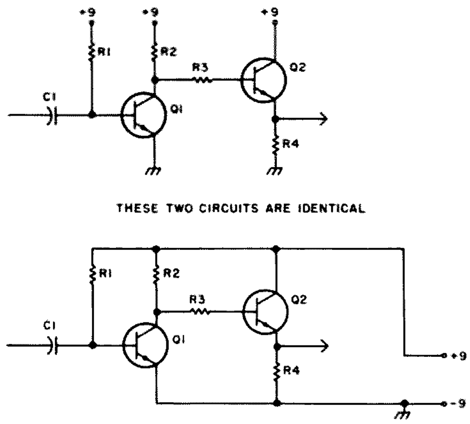


Fig. 5. Power-supply connections.

WIRE GAUGE	DIAMETER IN INCHES
1	.289
⋮	⋮
20	.032
22	.025
24	.021
26	.015
28	.012
⋮	⋮
50	.001

Fig. 6. Wire sizes.

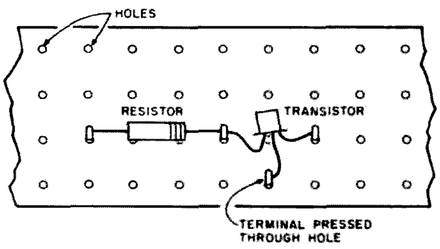


Fig. 7. Use of perfboard.

ers. If you need a two-conductor jack, and one lead is not supposed to be grounded, you will either have to mechanically insulate the outside of the jack from ground or get a three-conductor jack where you use the two inner conductors and ignore the third (grounded) lead.

Cable

If the circuit you are building is not used at VHF and a piece of coax is called for with a length of 12 inches or less, the coax is being used mainly for its shielding capability. You can safely ignore the impedance and pick a piece of coax on the basis of being able to fit it into your box mechanically.

Wire

Unless used for high-current leads, most solid-state circuits use just a few milliamperes per stage. Therefore, there is no reason to use wire sizes larger than number 22 or 24. As shown in Fig. 6, the lower the number the larger the wire diameter. Pick wire which is mechanically convenient. Soft plastic insulation strips very easily and conveniently, but if you have to solder a number of them in close proximity, the plastic tends to melt and burn, generally making a rather unsightly mess.

Printed Circuit Boards and Breadboards

Some construction articles provide either a PC-board layout or a commercial source for purchasing the board. If a layout is given, you can use the PC-board kits sold by several suppliers to make your own. However, if no board is suggested, you always can use a breadboard-type construction to build the circuit. Most hams have one or more breadboard circuits, neatly enclosed in a box, which have been operating in their breadboard form for many years. Even if your construction does not come out very neat, the flaws will be hidden by the enclosure you put the circuit in.

One of the simplest construction techniques uses perforated board such as that sold by Radio Shack, Vector, and others. The circuit is laid out just as it appears on the schematic, and every time a connection must be made, a small metal terminal or clip is inserted in a hole and the leads soldered onto the terminal (Fig. 7.).

Alternatively, general-purpose PC boards also are commercially available. They are arranged in a fixed pattern and, as shown by the dotted rectangle, integrated circuits plug in adjacent rows of holes (Fig. 8). A bus-bar system of feeding ground and voltage is used, where one bus is connected to the supply voltage and jumpered to the IC pin where required. Transistors and other parts can be mounted where convenient. A second bus is used for ground.

Also commonly available are small carrier boards which will allow you to wire up one or two integrated circuits (Fig. 9). Other parts are jumpered from one terminal to wherever required.

Generally speaking, sockets or molex® pins are a good idea for mounting integrated circuits. If you do have a problem, you can now unplug the IC and test or substitute without a massive and messy unsoldering job.

Plan It Out and Then Build

Take a careful look at what parts are required and make sure you can obtain them. Plan the layout of parts and decide what you are going to enclose the circuit in and where the jacks, connectors, and controls will be located. Don't hesitate to call for help. Often an experienced ham in the area can offer an immediate solution to your unique problem. But if this does not solve the problem, you can drop the author of the article a note. Enclose an SASE, and help will probably be on its way quite quickly. ■

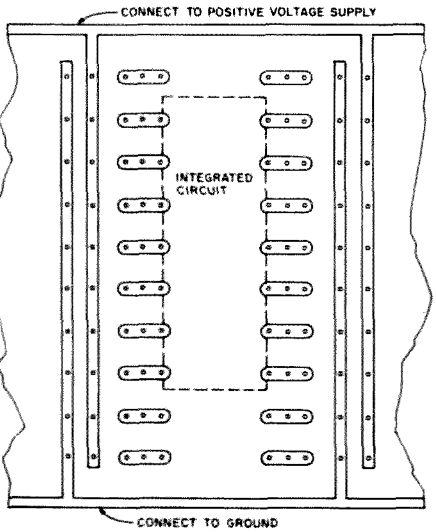


Fig. 8. Commercially-available PC board for breadboarding.

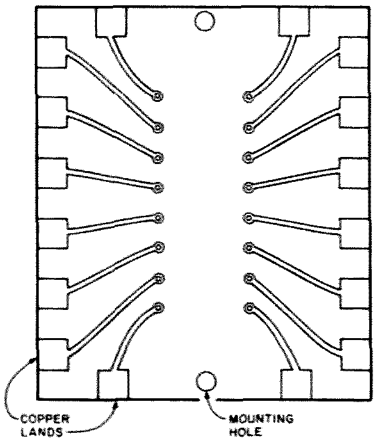


Fig. 9. Single-IC carrier board.

Glenn Jacobs KC7M
Poverty Flat AZ 85925

Coping with PC Boards

—it's not easy to be virtuous

"Admit it. You'd really rather build it. Any idiot can plunk down a charge card."

"Well, yeah . . ."

"Glenn, if you build it, it will give you pride and experience, and you'll know how to service it yourself."

"Yeah, but . . ."

"And it wouldn't cost nearly as much, and nobody would have one just exactly like yours."

So, I'm building. And my inner voice was right about everything it said. But there are a few things it *didn't* tell me. I found out the hard way, and I'm telling you so *you* don't have to "re-invent the wheel," like I had to.

I'm building. But so help me, when I see those full-page, full-color ads and a toll-free number and the sign of the yellow and orange overlapping circles, it's hard to keep at it. I could have any equipment I want for just a phone call and twenty "easy" payments. The path of virtue is harder.

Designing It

In the first place, I don't know much about vacuum-tube circuits and even less about solid state. Fortunately, I don't have to. The League[1] publishes *Solid State Design for the Radio Amateur.* It's a "cookbook." It shows three varieties of any circuit you could want—all pre-engineered and tested.

Redesigning It

Now, even with a cookbook, I can make mistakes. In fact, it's about even odds that I will make a mistake in a one-device gadget. It is far beyond me to put forty "stages" on a board as big as a *73* cover and have them all work. I decided to put each stage on a separate board and plug 'em all into edge connectors. That way if (when!) I make a mistake, I won't have to tear everything up.

I mailed off[2] for some PC board. It took three weeks to get here. They didn't send it until my check cleared.

Whittling It

PCB is funny stuff. I couldn't trace anything on it. I couldn't find any kind of carbon paper that would make a mark. Finally I rubbed yellow crayon on the copper and was able to trace faint lines. I cut on the lines and peeled up the unwanted foil in little-bitty strips with a point of a knife. It took half a day. But it worked. I got a nice little 40m CW receiver for my trouble.

Buying It

For my next project, I just sent off for ready-made custom boards.[3] They were nice, neat, correct, beautiful, and even had the parts placement marked. They worked perfectly. I made a mate for the last project. But I wanted to do these boards myself.

I sent off for ferric chloride.[4] This time I called up and told 'em my card number and they had the stuff delivered to my door in about three days.

Mixing It

The ferric chloride is a black, gritty powder. I mixed it with hot water in a plastic jug. The water got hotter. The powder that got on my hands turned into a brown goo all by itself and began to sting. I went and washed it off. When I came back, the grit I had spilt on the floor had turned into a nasty glop. That stuff absorbs water right out of the air! I wiped it up. The floor is now permanently stained several shades of brown, black, green, and gray.

Etching It

Anyway, now I was ready to begin. Or was I? I cut out a little piece of the high-priced board and drew a circuit on it in ink. I laid it in a plastic dish and poured some of the smelly brown juice over it. An hour later it looked gritty. Two hours later it was covered with a fine black sediment. I rinsed it in the sink and every bit of copper was gone. The thing might still make a banjo pick, but it would not make a circuit.

Resisting It

I cut out another piece. This time I drew my design with a felt marker. I baptized it for two hours in the ferric chloride soup and, behold!—a printed circuit. The remaining foil was rough and gritty—about half eaten up. But it would do. Now I knew for sure what to do. Very carefully I designed the first board. I felt-marked it and laid it away in the tobacco juice. In the morning there wasn't enough copper left on the

board to tell what it was supposed to have been.

Next I tried crayon. I suppose if crayon were the only resist in the world, we might make a go of it, but we wouldn't like it. It turned out rough and ugly. By now I wasn't trying to make any particular kind of board. I just wanted to see what would get me decent results.

Cursing It

Oh! I found a lump of etchant I had missed before. I stepped on it barefoot and stained my sole brown. I said some words that stained my soul deep purple. After I cleaned up the mess, I went to bed, disgusted.

Dreaming It

Suddenly I sat up. I had dozed off and dreamed I was painting a pattern with a tiny brush. That mimeograph correction fluid! I had a whole case of it! Mimeograph correction fluid corrects by drying into a plastic film. And it comes with a handy little brush built right into the bottle lid. I put on my pants and waddled out into the dark to my store.[5] There it was, cartons and cartons of it. I brought one in and annointed a little rectangle of copper with abstract designs and flooded it with the slop from the jug.

In the morning I rinsed it off and scrubbed it clean at the kitchen sink. Beautiful. My design was perfectly preserved in glittering copper.

Sharing It

Finally I have found *The Way* to do it. And I will share it with you. Just send a dollar and a double-stamped SASE to Glenn's Trading Post at Poverty Flat, Arizona 85925. I will send you a bottle of gen-u-ine Army surplus correction fluid complete with a nice little applicator brush built right into the lid. Guaranteed to delight you. Correct your stencils. Paint your nails purple. Make your own PC boards. (Who knows, it may even remove warts.) This is the best stuff since snake oil. You can even see your pencil lines on the foil through the fluid.

Drilling It

By 'n by I had the first board ready for parts. Nearly ready for parts. Gotta drill it. All my drills are too big. I went to a dozen hardware stores within a hundred miles. The smallest ordinary drill bit is a sixteenth of an inch. It's positively teensy. But the components just fell out of the holes. Even after I soldered them. The best I could do was bend the leads over hard after poking them through the holes. Then they would stay in place long enough to be soldered. But the holes were so large it left a quarter-moon gap around each lead. It didn't look neat. It didn't look professional. If I had wanted a ventilated board, I would have made a pattern of round holes on purpose.

"I need a smaller drill."

"No. You need smaller holes. Or, you need to be less picky."

"All I want is a drill half that size."

"There ain't any in eastern Arizona. You need something else."

"If it drills holes, ain't it a drill bit?"

"Not necessarily."

My wife broke a sewing-machine needle as I argued with the inner voice.

"Honey, get this broken needle out for me, will you, please?"

Grinding It

I did. A broken-off sewing-machine needle looks a lot like a little-bitty drill bit. I ground a bevel on the notched side of it with a whetstone and it looked a lot more like one. I chucked the shank into my hand drill and found it would go through PCB like a hot knife through butter. It made a neat round hole with the foil pushed up around the edge like the rim of a moon crater. And, the hole was too little for a resistor lead. But sewing-machine needles come in different sizes and for a buck at the friendly local notions counter, I had an assortment of drill blanks just the right sizes for component leads.

Concluding It

You can roll your own printed circuit boards without spending a fortune on special supplies and equipment.

You can draw your pattern right on the copper with an ordinary pencil and erase it until you get it right. You can paint directly on the board with mimeograph correction fluid. You can see your pencil lines right through the purple film. You can remove it with a fingernail. When you are satisfied with your pattern, a mixture of ferric chloride and water will etch it for you. Plain water will clean it up, with a little scrubbing.

If you can't get the size of drills you need, ready-made, you can make your own out of sewing-machine needles. ■

Footnoting It

1. American Radio Relay League, Newington, Connecticut 06111.

2. There are a lot of places. I got mine from Fair Radio Sales, Box 1105, Lima, Ohio 45802.

3. Again, there are several sources. Try Circuit Board Specialists, Box 969, Pueblo, Colorado 81002.

4. Meshna, Box 62, East Lynn, Massachusetts 01904. They may be out.

5. Glenn's Trading Post, Poverty Flat, Arizona 85925.

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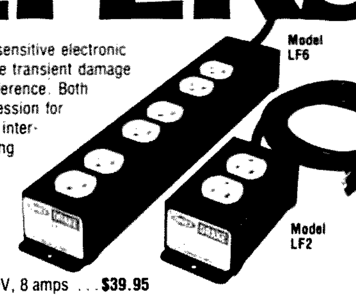

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'Lite Receiver IV

—the second half

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S. F. (Mitch) Mitchell, Jr. WA4OSR
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Mobile AL 36601

This is the second part of a two-part article on the 'Lite Receiver IV™.* In the first installment (May, 1982, *73*), we described our philosophy for designing a home-brew receiver that can be easily duplicated. The 'Lite Receiver IV is the culmination of that design philosophy. The receiver completes the home-brew system which started with our low noise amplifier (February, 1982, *73*) and easy-to-build downconverter (March, 1982, *73*).

The first 'Lite Receiver IV installment covered the 70-MHz bandpass filter/i-f amplifier board and the video demodulator board. Also included was an interconnection diagram showing how all of the boards were connected together. In this installment, we describe the audio, automatic frequency control, and metering circuits. For ease of building, printed circuit board layouts and parts lists are provided. A source is provided for etched and drilled printed circuit boards for those not wishing to "roll their own."

Dual Audio Board

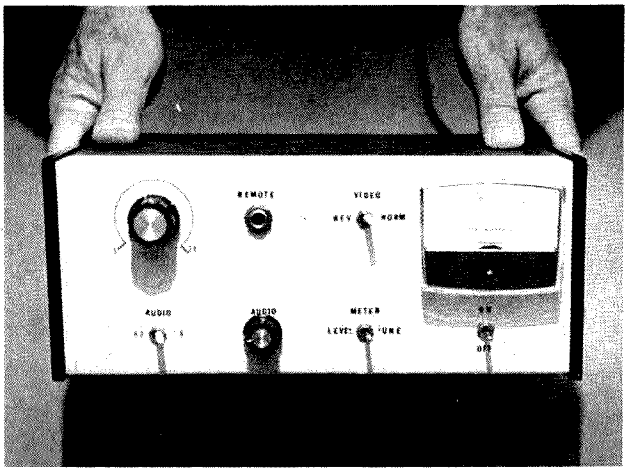
The audio circuit provides for switch selection of either 6.8-MHz or 6.2-MHz audio subcarriers from the satellites. The circuit shown in Fig. 1 is designed around Motorola MC1358 audio decoder ICs; however, RCA CA3065 or National LM3065 ICs can be used as direct replacements. The board can drive a small speaker and has a front-panel audio-level control if the speaker is used or the audio level from the MC1358s is sufficient to drive most rf modulators. Complete component cost, exclusive of the printed circuit board, should be around $15.00.

Construction

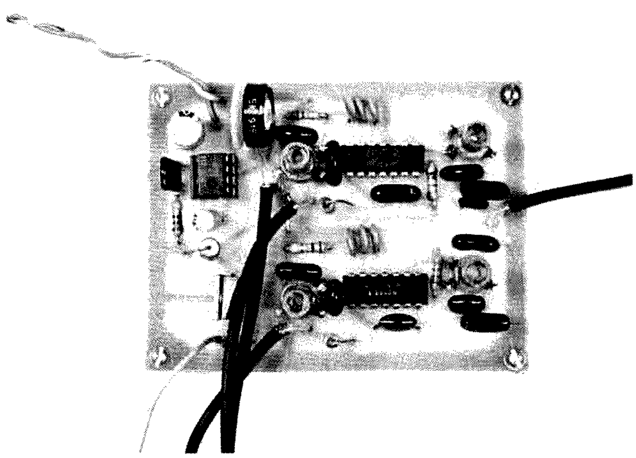
The printed circuit board and parts overlay, Fig. 2, make construction simple. We did not use sockets for the ICs; however, there is no reason not to use them with the relatively low rf frequencies involved. The coils are about $1.00 each from RCA distributors.

When building, you must decide on the options that

*'Lite Receiver IV is a trademark of Martcomm, Inc.



Front panel of the 'Lite Receiver IV.



Top view of the 'Lite Receiver's dual audio board.

you want. If you do not plan to use a speaker but need audio only to drive your rf modulator, then the LM386 and its associated components can be eliminated. In that case, the front-panel level control will not be needed, but be sure to install the two 50k-Ohm printed circuit board pots since they control the amount of audio available from the MC1358s. If the LM386 is not installed, the center pole of S1 is connected to a rear-panel jack for connection to your rf modulator. If the LM386 is installed, then the output of the LM386 is connected to the rear-panel jack for connection to a speaker or to your rf modulator. We use the complete circuit as shown so that a small speaker can be used when we carry the receiver out to the antenna to make adjustments.

If you decide that you want the speaker drive capability, replace the two 50k-Ohm PC board pots with 10k-Ohm, quarter-Watt resistors. The 10k-Ohm resistors provide fixed attenuation of the audio level from the MC1358s. The front-panel control is then used for audio level for both the LM386 and your rf modulator.

Note that picofarad-size capacitors are silver mica, with all other capacitors ceramic or electrolytic.

Tune-Up Procedure

For tune-up, it is necessary to have a signal generator or use a signal off the air. If your signal generator has modulation capability, enable the modulation and tune the output of the generator for 6.2 MHz. Tune L1 for maximum audio level and L2 for best audio (which probably won't be very good because most signal-generator modulation is AM). If the signal generator is CW only, then tune both L1 and L2 for maximum quieting. If the LM386 was omitted, adjust the 50k-Ohm pot for correct modulation level for your rf modulator.

To tune the 6.8-MHz circuit, simply repeat the above procedure with the signal generator set for 6.8 MHz and tune L3 and L4 as described.

Off-the-air tune-up can be performed using the same procedure as above. However, video will have to be detected by the video demodulator board since the audio is a subcarrier riding on the video signal. If the signal-generator tune-up method is used, it still will be necessary to fine-tune once you have a signal off the air. Simply adjust for best audio quality.

If the LM386 and a speaker are used all the time, be sure to heat-sink the voltage regulator and the LM386. This completes the audio section of the receiver.

Afc/Metering Board

The afc/metering board gives afc control for the mix-

PRINTED CIRCUIT BOARDS

Printed circuit boards are available from Martcomm, Inc., PO Box 74, Mobile AL 36601. The dual audio board is $12.00 and the afc/metering board is $15.00. Add $1.75 per order for first class postage.

DUAL AUDIO BOARD
Parts List

2 MC1358 ICs. See text.
1 LM386 IC
1 7812 voltage regulator
2 50k-Ohm PC board mount pots. See text.
1 10k-Ohm pot, panel mount. See text.
1 10-Ohm, ¼-Watt
2 220-Ohm, ¼-Watt
2 10k-Ohm, ¼-Watt. See text.
2 4-pF silver mica
2 12-pF silver mica
2 27-pF silver mica
2 33-pF silver mica
7 .01-uF disc ceramic
4 .047- or .05-uF disc ceramic
1 .05-uF disc ceramic
3 1-uF electrolytic
1 10-uF electrolytic
1 100-uF electrolytic
1 SPDT switch, panel mount
2 coils, L1 and L3, transformer-sound/i-f, stock number 130120, from RCA PM200 sound board.
2 coils, L2 and L4, coil-discriminator, stock number 130121, from RCA PM200 sound board.
1 printed circuit board, single-sided, G-10, available from Martcomm, Inc., PO Box 74, Mobile AL 36601.

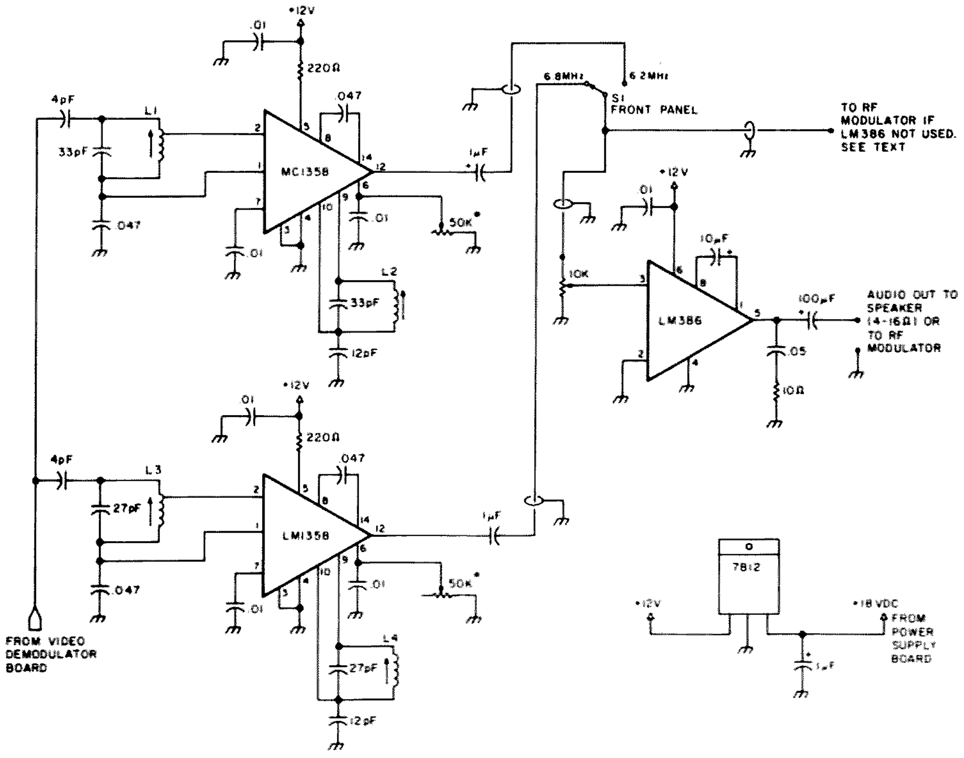


*Fig. 1. Dual frequency audio demodulator and amplifier schematic. *See text. All pF capacitors are silver mica. All others are disc ceramic or electrolytic.*

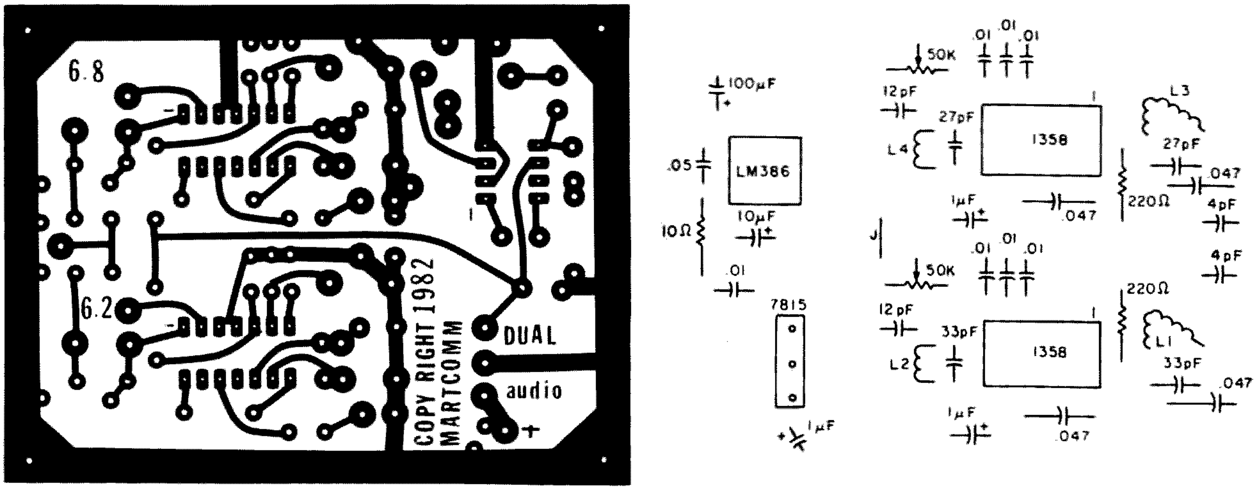


Fig. 2. PC board and parts layout for the dual audio board.

AFC/METERING BOARD
Parts List

1 LM324 IC
1 1k-Ohm PC board pot
2 5k-Ohm PC board pots
1 5k-Ohm panel mount pot
1 10k-Ohm PC board pot
2 1k-Ohm, ¼-Watt
2 2.2k-Ohm, ¼-Watt
6 10k-Ohm ¼-Watt
1 1 megohm, ¼-Watt
3 .01-uF disc ceramic
1 .022-uF disc ceramic
2 1-uF electrolytic
1 47-uF electrolytic
2 1N270 germanium diodes
1 0-1-mA meter
2 SPDT switches
1 printed circuit board, single-sided, G-10, available from Martcomm, Inc., PO Box 74, Mobile AL 36601.

er local oscillator (vto) and provides drive for a relative signal-strength meter.

The signal-strength meter is not a necessity for the receiver. Still, meters seem to impress people and we are no exception. It does serve a very useful purpose, however. The meter comes in handy for adjusting your LNA and antenna, and it gives a relative indication of signal to noise for your complete system.

As can be seen from the schematic in Fig. 3, there are four op amps used on the board. We needed three for the afc circuitry, so one was left over. We decided to put it to use to drive the meter. The 70-MHz output from the i-f filter amp is picked off through a coaxial tee coupled with a .01-uF capacitor. The rf is then fed to a voltage doubler composed of two 1N270 germanium diodes. The dc from the voltage doubler goes to an op amp connected as a non-inverting buffer. The op amp drives a 0-1-mA relative signal-strength meter.

Afc Circuit

The automatic frequency control (afc), like the metering circuit, is not an absolute necessity. But it sure is nice to have it lock the vto onto a transponder, as the vto does drift in frequency due to ambient temperature fluctuations.

It was decided to provide for afc with normal or inverted video. There is not much inverted video on the satellites, but occasionally you do run across an "upside-down" transponder. Also, on a single-conversion system such as ours, it is possible to tune in the image of a transponder. But if the video switch is in the "NORM" video position, the afc will "push" the image signal away instead of locking onto it.

Refer to the schematic in Fig. 3. At the afc sample

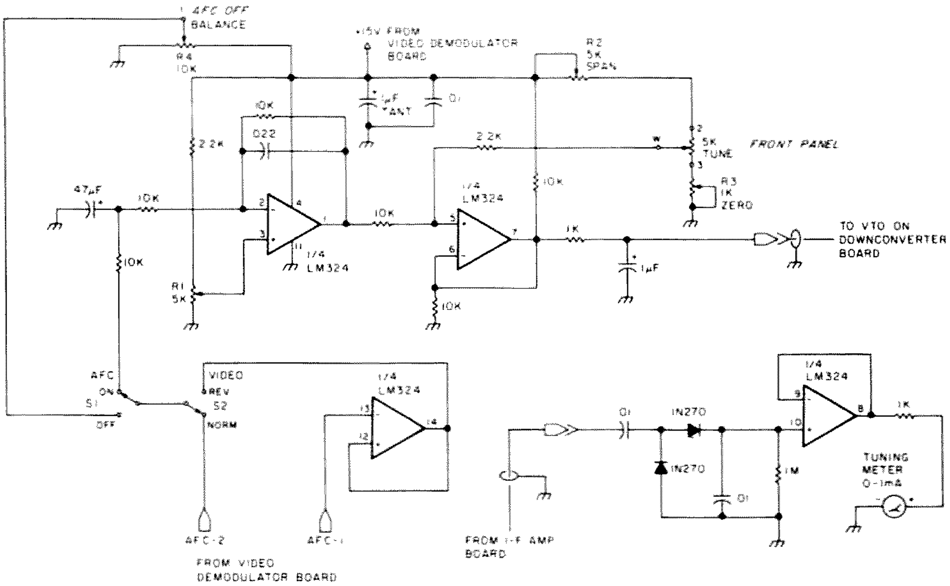
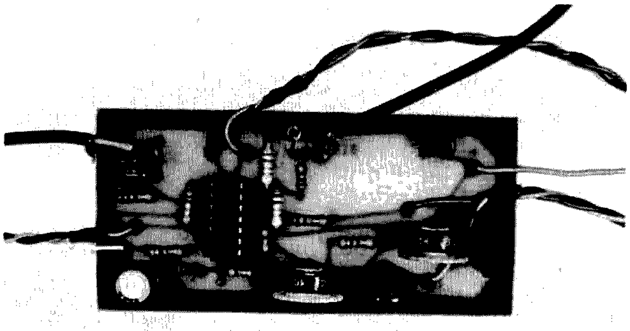
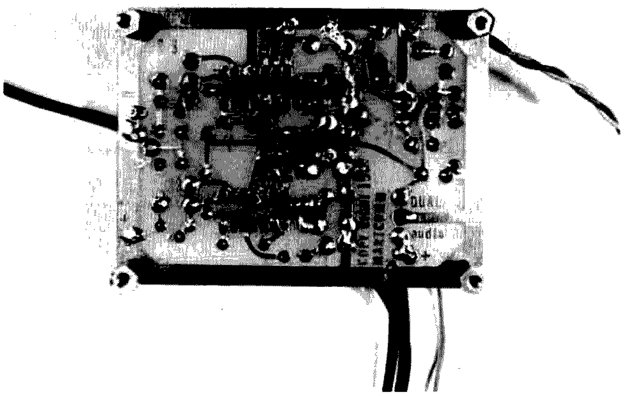


Fig. 3. Afc/metering board schematic.



The 'Lite Receiver's afc/metering board.



Bottom view of the dual audio board.

point, AFC-2, we are not detecting a peak or a null, but instead a dc level which is compared to a reference signal at pin 3 of the LM324 quad op amp. The first op amp in the chain is wired as a non-inverting voltage comparator. Its output is summed with the transponder tuning pot voltage to supply the tuning voltage for the vto in the downconverter (mixer). A span pot, R2, and a zero pot, R3, are provided to calibrate the transponder tuning pot, since vtos have different voltage-to-frequency ratios.

The third op amp is used as an inverting buffer for inverted video. As can be seen on the schematic, the video normal/reverse switch is a double-pole, double-throw switch. This switch reverses the afc action when you switch from normal to inverted video. Also, provision was made to turn the afc off but not change the transponder tuning pot calibration. R4 sets the afc reference level the same as the afc voltage of a properly tuned transponder when the afc is switched off.

Construction

A printed circuit board layout and parts overlay are shown in Fig. 4. There is nothing critical about the construction of this board. Just use good soldering technique and keep components flat against the printed circuit board. Use an IC socket for the LM324 since tune-up of the board is done before the LM324 is installed. Do not connect the tuning pot wiper to point "W" on the PC board yet.

Tune-Up

Connect the tuning-pot wiper to the vto at this time. Connect the AFC-1 and AFC-2 points to the video demodulator board. Connect to the +15 volts regulated and dc ground return on the video demodulator board. Set the video switch to "NORM" and the afc switch to "ON."

With the LM324 unplugged, test for +15 volts at pin 4 of the LM324 socket. Tune in a transponder and measure the voltage at pin 2 of the LM324 socket. Move the meter probe to pin 3 on the socket. Then, using R1, set the pin 3 voltage to equal the pin 2 voltage. Now switch the afc switch to the "OFF" position. With the afc switched "OFF," set the pin 2 voltage with R4 to the same voltage as with the afc switch "ON." Now, remove power and plug or solder in the LM324. Connect the tuning-pot wiper to point "W" on the afc board, and connect the afc board output (marked vto) to the vto. Be sure to use coax or well-

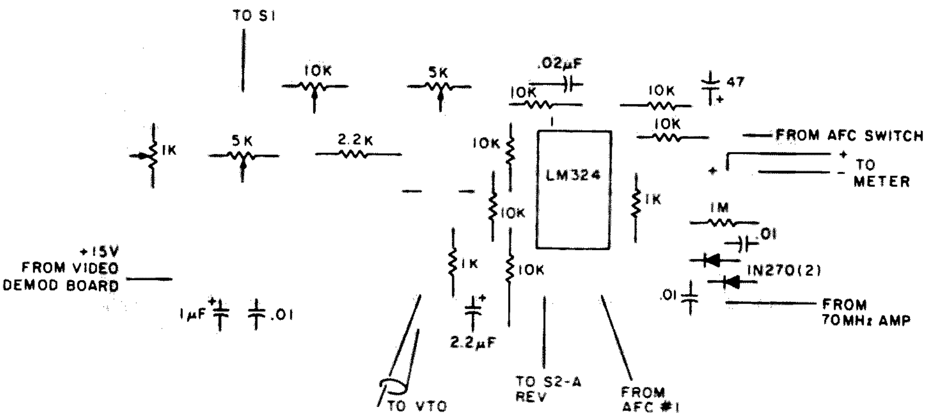


Fig. 4. PC board and parts layout for the afc/metering board.

shielded cable to connect the output of the afc board to the vto. (Usually, the vto will be remotely mounted in the downconverter, located at antenna.) The afc board output is controlling the voltage-controlled oscillator in the mixer, so any stray signal or noise spikes picked up by the cable will result in the vto being "modulated" and will cause it to change frequency with very undesirable effects on the picture.

With the afc switch "ON" and the video switch set to "NORM," the tuning pot will act like a channel switch. As the tuning pot is rotated, the afc will try to hang onto a transponder as long as possible; then, it will "jump" to the next transponder. Because of the "jump," the effect is to "switch" transponders! Finally, adjust the zero pot, R3, to set transponder #1 close to full counterclockwise position of the tuning pot. Adjust the span pot, R2, to set transponder #24 close to the full clockwise position of the tuning pot.

Now, with a 0-1-mA meter connected to the meter output, tune in a transponder and impress people.

Rf Modulator

We have not described the rf modulators that we have tried since we just haven't found a circuit that we are happy with. At present, we are using the rf modulator in our RCA video tape players. The rf modulator therefore costs only four times what the complete 'Lite Receiver IV costs!

Correspondence

Because of the complexity of the 'Lite Receiver IV, we may not have answered all your questions. We'll be glad to try to answer any questions that you might have if you include a self-addressed stamped envelope and are patient in awaiting a reply. ■

PLESSEY- AVANTEK

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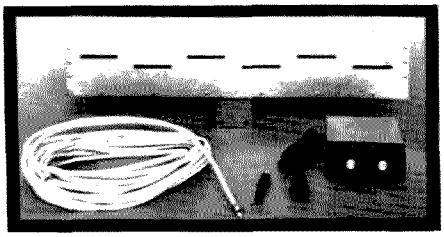

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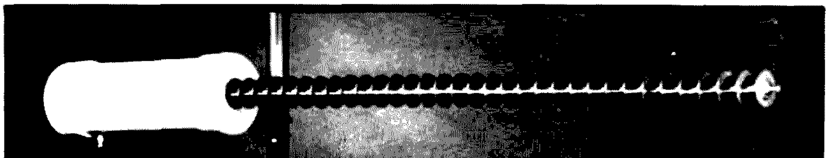

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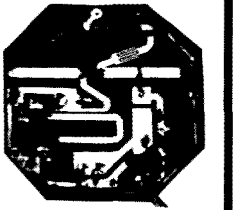

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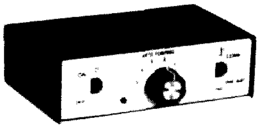

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TVRO Transducer

—waveguide-to-coax transition

Trans-duc-er (trans-doo'-sar) n. Any device through which the energy of one power system may be transmitted to another system, whether of the same or a different type.

Now that you know the dictionary definition of a transducer, let's look at the satellite TV definition: the gizmo that hooks the antenna horn to your LNA.

Simply stated, the transducer is a section of waveguide 3/4 of a wavelength deep with the back closed. The waveguide is a transmission line and has a velocity factor different from that of free space. A signal-pickup probe is installed 1/4 wavelength from the back (closed end) and 1/4 wavelength from one side of the box. The 1/4-wavelength spacing ensures that any 4-GHz energy that gets past the probe and is reflected from the back of the box to the back side of the probe will be in phase with the signal arriving "head on," since 1/4 wavelength from the probe to the back of the box plus 1/4 wavelength from the back of the box back to the probe equals 1/2 wavelength. The 1/2-wavelength spacing minimizes phase distortion and signal cancellation.

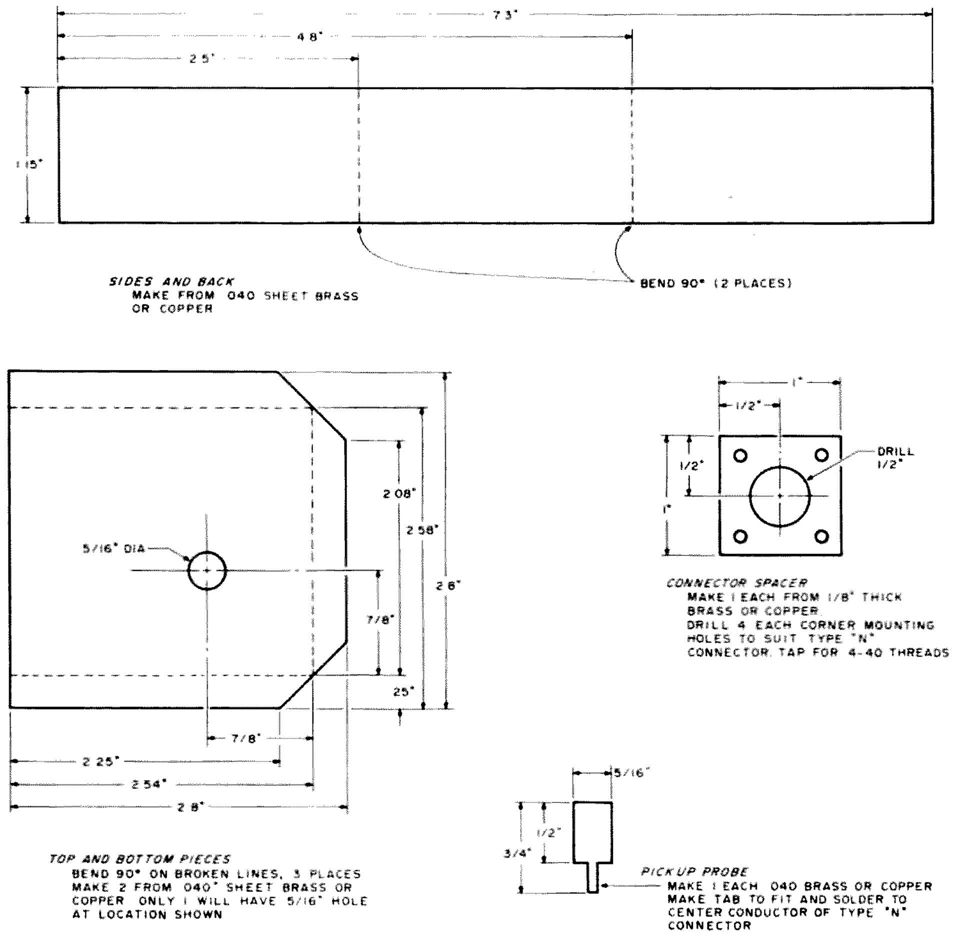


Fig. 1. Parts dimensions and bending instructions.

Two Methods

Our transducer can be built in one of two ways. If you are lucky and can find some 4-GHz copper waveguide, most of the work is already done for you. Just cut off a 2.5" section of the waveguide. Take a scrap piece of waveguide and cut a piece to fit the back of the 2.5" piece. Solder the two pieces to form a box with one end open. Make sure

that no solder gets inside the box. Using the instructions below, prepare and install the 1"-square piece, the probe, and the coax connector. This waveguide method was used to build the transducer in the photo.

If you are not lucky enough to have a friend with a source of waveguide, you will have to "bend" your own. The material needed is .040" brass shim stock or sheet flashing copper. Most large sheet-metal shops have small scraps of such material that can be purchased at a very reasonable price.

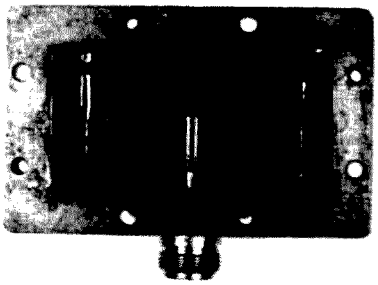
Cut the 7.3" × 1.15" piece of material and bend it to a U shape as shown in Fig. 1. Cut two pieces 2.8" × 2.8". (You probably can get the sheet-metal shop to cut the material with their shear for good clean edges.) Bend the edges of the two pieces 90 degrees as shown in Fig. 1.

Drill one 2.8" × 2.8" piece as shown. This piece will be the bottom of the box, so that looking into the front of the box, the probe hole will be in the bottom on the right-hand side. The photo shows how the probe is offset.

Thoroughly clean all pieces in preparation for soldering. Assemble the three pieces to form the box, and clamp or wire them together. If necessary, slightly bend the U-shaped piece outward to ensure a tight fit when the top and bottom pieces are installed. With a large soldering iron or small propane torch, solder all seams. Be sure that *no* solder gets inside the box. If any solder gets inside, clean it out; you want a very smooth surface inside the box to minimize interference with the signal energy.

Installing the Probe

The 1"-square connector spacer (see drawing) must be made from 1/8" brass or copper. Drill a 1/2-inch hole in the center of the 1" piece. Then, using the type N chassis-connector mounting holes as a guide, drill and tap the piece for 4-40 screws. Sweat-solder the 1"-square plate centered over the 5/16" hole in the bottom of the box (now, transducer!). Cut the pickup probe from .040" brass or copper scrap to the dimensions shown in the drawing. Solder the probe to the center connector of the type N connector. The distance from the connector flange to the end of the probe is 13/16".



End view of a transducer made from copper waveguide. Note the clean, smooth interior.

Now install the connector to the waveguide, using 4-40 screws, making sure that the flat side of the probe is toward the front of the waveguide.

Connecting to the Horn

After constructing your transducer by the easy or hard method, you still have to mechanically connect it to your antenna horn. This is where a WR-229 waveguide flange comes in real handy. If you don't have access to a WR-229, you can make one from 1/8" brass or copper. Mild steel also could be used, but is more difficult to solder. Refer to Fig. 2 for the dimensions if you have to make your own.

Solder the flange flush to the front of the transducer. Sand or file off any excess solder for a smooth transition from the flange to the transducer. Drill mating holes in the flange to mate with the flange on your horn. We use .141" hardline coax from the transducer to the LNA. This small coax can be bent easily so that the LNA can be installed directly behind the transducer.

Final Comment

We have heard of several people building horns and transducers from double-sided printed circuit board. We have gone the PC-board route, but with very poor results. Stick with the sheet copper or brass and you should get good results with a minimum of trouble. Good transducing! ■

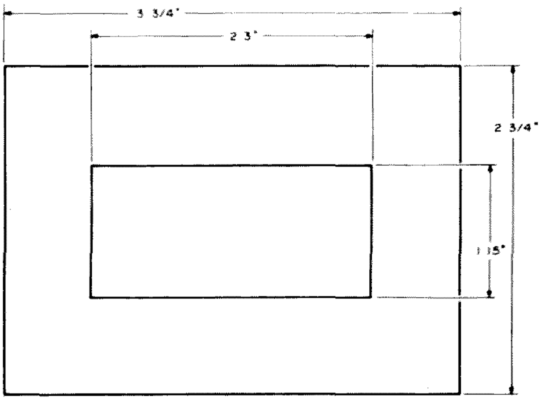


Fig. 2. WR-229 waveguide flange dimensions. Flanges may be purchased or made from sheet brass or copper 1/16" thick or heavier. While not absolutely necessary, some method must be used to mate the transducer to the horn. Solder the flange flush with the transducer.

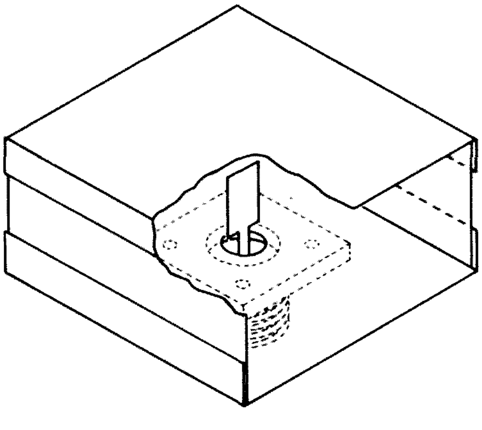


Fig. 3. Three-D drawing of the transducer.

Stephen Gibson
PO Box 38386
Hollywood CA 90038

The MTV Music Box

—Satellite Central, part VII

Part of the fun of TVRO experimenting is searching for new signals. While video is an easy mark, the real gold is sometimes harder to find, especially since new services keep popping up. The "video records" are a good example. Slide by transponder 11 on Satcom 3 (131 degrees west), and you'll find Music Television (MTV), a cable service from Warner Amex.

You may wonder why you are seeing rock groups blasting their brains out in near silence. It's because the audio portion of MTV is not on your typical TVRO receiver outputs of 6.8 or 6.2 MHz. Instead, different subcarrier frequencies were picked. Security? Perhaps.

Rock and roll music may not be your cup of tea, but the MTV delivery technique may become popular and worthy of more investigation since it is sent in stereo. And more important, you can experiment with a neat trick that mighty Warner never thought of!

Stereo Trickery

Just having two sound detectors to get stereo isn't enough. You need a decoder, too. Don't bother with a stereo FM-decoder setup because it won't work. MTV combines both channels, L+R, on one subcarrier and sends the difference between the channels, L−R, on the other subcarrier.

You can hear the sum channel on a 6.62-MHz subcarrier and the difference on 5.8 MHz. All you need to do is a little addition and subtraction with the electronics, and voilà...they separate into left and right! If you add the L+R signal to the L−R signal, the +R and the −R cancel, leaving just L, or 2L, if you want to be technical about it.

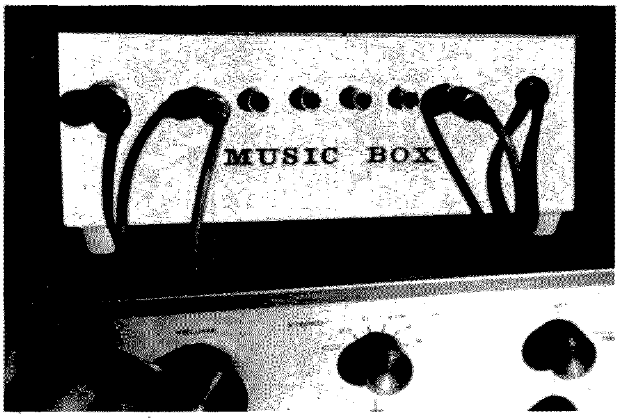


Photo A. Front view of the Music Box.

Likewise, if you subtract L+R from L−R, you get just 2R. The secret to all the addition and subtraction is a "matrix," which is a short and fancy way of saying two op amps from Radio Shack.

Before you rip the top off your receiver and start tweaking, you should consider an option. Why not build two more sound sections plus whatever else is necessary in a separate box, sparing your receiver? Don't worry if you are a Novice or your last project was an old tube-type Selecto-Jet. I've found an easy way for you to build this gadget.

Simple Circuit Details

The unit connects to your TVRO receiver at the same place your internal sound subcarrier-detector circuits tap off. Referring to Fig. 1, the detected composite video with audio subcarriers is coupled to two separate subcarrier sound detectors. One detector is tuned to

6.62 MHz and will give you an L + R output. The other detector is tuned to 5.8 MHz and delivers an L − R output. Each detector output feeds two op amps. I used a TL084 because it is cheap (available at Radio Shack) and works rather well. You get four amplifiers in a single chip. That sure beats the 6SN7 that some of you may remember.

A portion of the L + R detector output feeds the inverting input of the top op amp in the diagram. The L − R detector output feeds the non-inverting input. As in typical op amp fashion, its output is just the difference between the two inputs. So much for the subtraction part of the matrix. Addition is performed in the bottom op amp by summing the L + R and L − R detector outputs into the inverting input. Isolation is superb in this configuration because the inverting input is driven towards ground.

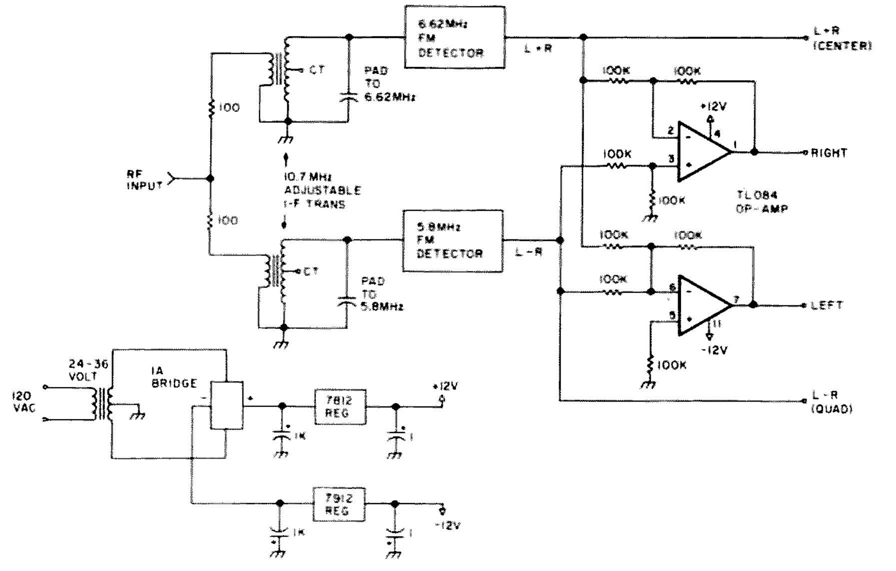


Fig. 1. Two PM-200 subcarrier detectors and a TL084 op amp are all you need to hear MTV satellite stereo.

An Evening Project

The subcarrier-decoder circuits in May's edition of "Satellite Central" will work very well. You can make a PC board for two detectors or use perf-type vectorboard and hand-wire the circuit in record time. Or you can even buy some dual-sound-section subcarrier PC boards from one of the *73* advertisers and just stuff 'n solder.

But if you are in a rush (and who isn't, nowadays) or if you are just learning about electronics, I suggest you take the lazy way and simply buy two RCA XL-100 sound-section modules like those described last month. Servicemen call them PM-200s. These little modules are complete TV-set sound sections and simply plug into the popular XL-100. Of course, they are tuned to 4.5 MHz (TV sound), but we can tweak them to the frequencies we want. In fact, we can modify them so that we get pretty hi-fi, too. Get two RCA MAA001As from a local RCA distributor. They run about 15 bucks each. You may be socked with a $3.00 dud charge.

Modification of the PM-200/MAA001A modules is very easy. We simply reduce the values of two capacitors so that we can tune higher than 4.5 MHz and then add two more capacitors to get better sound. Referring to Fig. 2, remove the T299 can and change C290 (82 pF) to 50 pF. Replace the can. Then change C295 (68 pF) to 25 pF. Now the unit tunes from 5.5 to nearly 8 MHz.

Next, solder a .01-μF capacitor from pin 13 on the CA3065 IC to a ground trace. This sets the de-emphasis to 75 μsec using a resistor inside the chip. Then solder a 5-μF (or so) capacitor from pin 8 on the CA3065 to a spare trace. If you don't see a spare trace, then cut the trace from pin 8 on the CA3065 leading out to the edge of the board and solder the cap across this trace cut. Just be sure the cap is polarized (end with + on it) towards the chip. Now you have a dc-blocked output to your amp. We don't use the preamp inside the chip because a quick look at the distortion specs would drive any audiophile back to AM radio!

Last, solder a 50k PC-type mini-pot from pin 6 on the chip to a ground trace. This is a volume control that we use in the mixing process. You can use larger shaft-type pots and mount them on the front panel, but they are likely to get bumped later on and will only reduce stereo separation. So why bother?

Depending on your TVRO receiver, you may need an input bandpass filter to cut noise from the video and adjacent audio subcarrier. The input coil (T299) works pretty well, but a cheap 10.7-MHz FM i-f transformer padded down to the proper

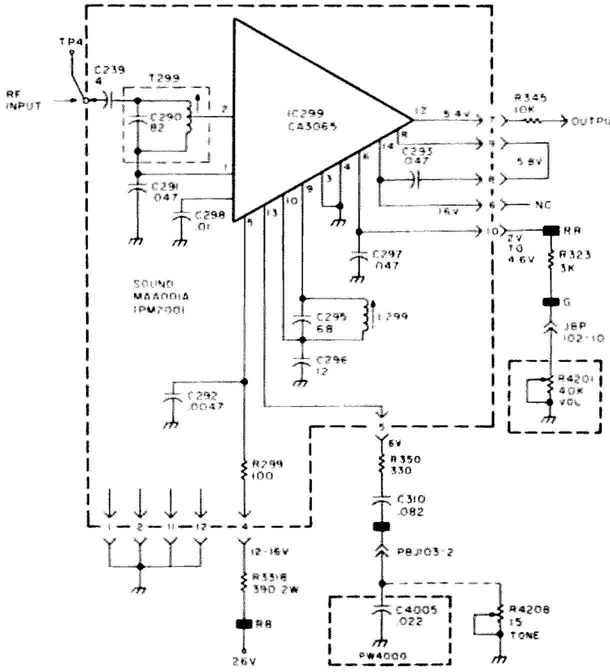


Fig. 2. The RCA PM-200 uses a CA3065 quadrature FM-detector IC for 4.5-MHz audio. The few mods discussed in the text will make it perform very well as a stereo sound decoder.

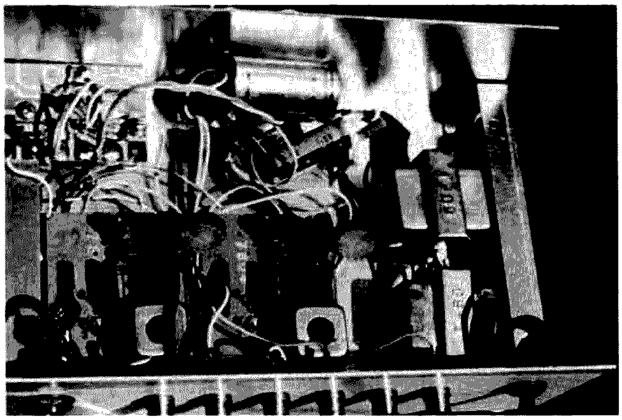


Photo B. Clean out that junk box with this project since nothing is critical. For example, two 12-18-volt transformers can be used instead of a single 24-36 volt. Even another op amp likely will work.

frequency knocks out what little noise is left. Not all transformers are the same, so a gdo or an rf generator will separate the winners from the losers. The secondary usually has a center tap.

Junk Box Jubilee

I decided to take a strictly plain-vanilla approach since I knew my little Music Box would soon be lost in the never-ending wire jumble behind my preamp. I used a utility box and mounted RCA jacks for all the outputs to my stereo system. (See Photo A.) The rf input was a lowly phone jack since I believe in using everything in the junk box. Use mini-coax if you have some. The input transformers can be soldered to the bottom of the PM-200s. The op amp was mounted on an experimenter's breadboard. All boards were mounted on standoffs. The PM-200 already has a hole in it for 6-32 hardware. Be sure to use voltage regulators to smooth the ripple. The op amps won't see ripple when running from a bipolar supply, but the little PM-200s want pure dc.

For the most part, construction is not critical other than the suggestion that you use coax to feed the PM-200s. Also, you should use 5%, ¼-Watt resistors in the op amp matrix (all 100k). While the pots on the detectors can be used to compensate for tolerances, we do want the tune-up process to be easy.

Next, you should modify your receiver. Find the location where the 6.2- and 6.8-MHz detectors connect. This is usually an emitter follower after video detection. Tap in with a dc-blocking capacitor. Then run more mini-coax to a BNC, type F, or RCA jack that you mount on the rear of the receiver. Take your choice. Use what you have. The signal is then patched to the Music Box with still more coax.

Tune-Up Hints

There are two ways to make the Music Box play. You can simply set both 50k pots for minimum resistance (that's maximum volume) and tweak the input transformers, the T299 coils, and L299 coils for sound. But knowing which subcarrier you are on may be a trick. Add to that the possibility that you may have both detectors tuned to the same carrier, and you're sure to see there must be a better way.

Use a signal generator set to 6.62 MHz. Feed it into the unit. Put a scope on pin 9 of the IC on the 6.62-MHz board (L+R) and tune the coils for maximum. Back the generator down below limiting and peak again. Do the same procedure for the other module (L−R), but set the generator to 5.8 MHz.

If the generator can be frequency-modulated by an internal oscillator, set it to ±75-KHz deviation and adjust the L299 coils on each module for the cleanest waveform. Depending on the particular run of PM-200s, you may need a resistor across L299 to lower its Q a small amount. A THD analyzer is a better eyeball if you have one. Without an analyzer, you are stuck with having to use your ear to fine-tune L299 for minimum noise and distortion.

While we're on the subject, don't expect the Music Box to play very well if your system has any sparklies. And narrowing the receiver i-f bandpass doesn't count, despite the picture improvement you'll likely see. It's what you'll hear that really counts. The first time a solid-color field is displayed (wider carrier deviation), you'll see and hear what many call frizzies, the bane of all "near threshold" systems. Even with music, nothing beats a good LNA and a large dish. Nothing.

At this point, you should be able to connect everything and hear pretty good stereo. Use headphones to verify. Some of the music is in mono, so don't worry if your first blast of sound is in the middle of your head. If you used 5% or better resistors on the op amps, you may be finished. Otherwise, the two 50k pots may need adjustment for maximum separation. Tweak either pot for best aural

WHY QUAD?

Back in the dark ages of stereo, David Hafler of Dynaco was experimenting with techniques to eliminate the so-called "hole in the middle" between left and right channel speakers—see Fig. 3(a). From that effort came a center-channel speaker which was simply the left and right channels combined (L + R) and played 6 dB softer. Then he went one better and suggested a single speaker *behind* the listener to add ambience. Logically, this ambience channel would consist of the difference between the channels, or L − R. Remember, we started with only two channels from tape or disk. This was revolutionary to audiophiles, but old hat to motion-picture people who'd been doing it for years with Cinemascope and 3D. (Funny how simple technology doesn't cross-pollinate now and then.)

Anyway, Michael Gerzon in England improved on the idea with the typical left- and right-front setup by feeding the difference (L − R) to separate speakers located at "left-rear" and "right-rear" and out of phase—see Fig. 3(b). It sounded so good that record people started recording ambience with a reverse matrix setup. Then they tried discrete channels, and you had technology go mad with the consumer wondering which system to choose. So much for history. Most stereo recordings have some ambience imbedded in them, so this technique is worth the extra effort to track down an old amplifier and two small speakers to fiddle with quadraphonics.

A 5th Channel?

If the front speakers are widely separated, you can connect a 5th channel to go between them. This will indeed reduce separation but tends to fill the "hole in the middle" effect. Cinema sound processors use this technique with an agc to restore apparent separation. Since a signal that would appear to be located at a point in space between the speakers would have to be coming from both the left and right channels, we must assume that it is the sum of the channels, or L + R—see Fig. 3(c). So feed another amp with the L + R output of the Music Box and place the speaker between left and right speakers.

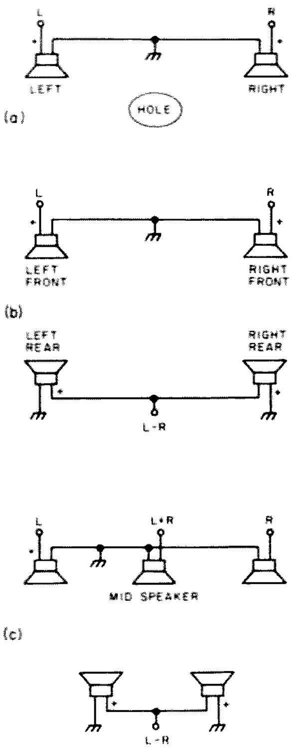


Fig. 3. Evolution of four- and five-channel sound. (a) Stereo, (b) quad, and (c) five-channel system.

separation or connect the Music Box outputs to the horizontal and vertical inputs of an oscilloscope. Without sweep, you can adjust the detector pots for a 45-degree angle trace on the CRT when mono is being transmitted. You'll see a "ball of yarn" display when stereo is being sent. Of course, you can always adjust for the most symmetrical jumble. What else would one do for rock and roll?

Next, connect the speakers. Watch phase because it is everything in a quad setup. If you are unsure, then first place a 1.5-volt cell momentarily across the voice coil of each speaker and note in which direction the cone moves. Mark the speaker lead with a + when the cell polarity causes the cone to move outward. All this is arbitrary, of course, but serves to give you a reference from which you can work.

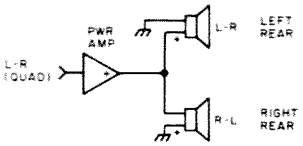


Fig. 4. Hookup for quadraphonic sound.

Music Box Bonus!

Sending the sound tracks in stereo was a pretty good idea. But what the Warner people didn't option was quadraphonic sound (at least until they read this)! And the little Music Box can do it. Quad sound? Yeah. . . and does it sound neat! And if four channels don't grab you, then how about five channels? It's just sitting up there on the bird waiting for you to snatch it!

For a quick trip into the history behind four- and five-channel sound, see the box. To get quad, just take the Music Box's L − R output, run it through a power amplifier, and connect two speakers as shown in Fig. 4.

Note that the speakers on the amplifier's output are connected in parallel but out of phase. The L − R goes on the left rear as you face the main speakers. The R − L goes on the right rear. Since the rear speakers will be radiating only ambience, you don't need to use the best that money can buy. Small bookshelf units work fine.

Setting levels for quad is a matter of taste. The ambience effect is very pronounced if the rear levels are high. But the stereo effect is reduced somewhat depending on the room. This is also true of the center channel. Too much level and separation goes away. As a rule, start your adjustments with the center and rear channels about 6 dB softer than the main left and right. And. . .oh yes. . .remember the threshold of pain is still +120 dB. But it may be less with rock and roll! ■

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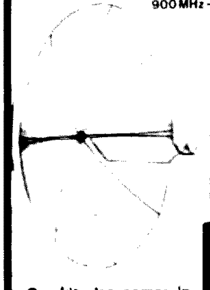

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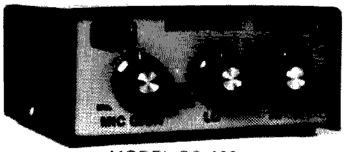

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—SWLing from Cairo to Kuwait

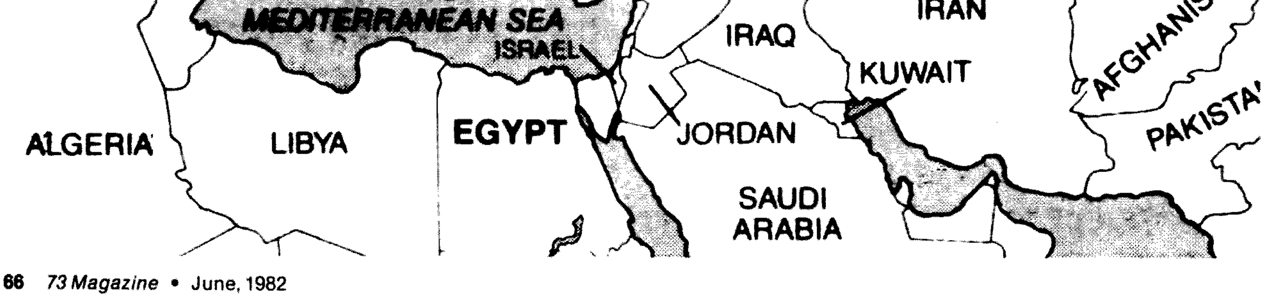
The assassination of Anwar Sadat, President of Egypt, was simply the latest, at that time, of a whole series of "incidents" in this conflict-torn area. The warfare between Israel and Egypt a few years ago, the fighting between Iraq and Iran, the invasion of Afghanistan by the USSR, and the ever-threatened stability of Saudi Arabia, Kuwait, and other Arab oil-producing states are all part of the turbulent Middle East scene. For a clear-cut, direct, day-by-day picture of this explosive part of the world, listen to your shortwave radio. All the countries mentioned above, plus others, have daily programs in English that can usually be heard well in North America. And you will find it interesting to compare the different viewpoints of these nations.

Radio Cairo from Egypt usually has a pretty good signal into North America. Its English programs can be heard at 2215-2345 GMT on 9805 kHz and at 0200-0330 GMT on 12.000 and 9.465 kHz. A 250-kW and a 100-kW transmitter are all the station has. Its programs always open with the sound of chimes (sounding suspiciously like Big Ben in London) and the words from a woman announcer: "This is Cairo, this is Cairo." Following this is a ten-minute news program. Then comes a regular pattern of music followed by a discussion of some timely topic, usually related to the Middle East. The music is Middle Eastern, reminiscent of Egyptian belly-dancing scenes in old movies. The music goes on for about ten minutes and then for 15 minutes you hear talk. Then back to the music, and so on. This is the regular daily program format. However, like the good broadcasters they are, Radio Cairo is not afraid to break out of the mold if the occasion calls for it.

If you had been listening to Radio Cairo on the evening that Sadat was killed, as I was, you would have been in for a most interesting experience. As soon as the official announcement of Sadat's death had been made, Radio Cairo discarded its regular format and put on a fascinating program about the late president. They covered his rise to fame and his accomplishments while president, and then switched to a report on the background of his successor, Hosni Mubarak.

To me, this was shortwave radio at its best. Such experiences give the listener the opportunity to go to the sources of major stories, wherever in the world they take place, and to get on-the-spot coverage that is usually way ahead of your local radio or TV news report.

Perhaps the most extensive broadcasting job in the



Middle East is done by Israel. Kol Israel, the voice of Israel's External Service, beams some six hours of English-language programs into North America, many of them very popular with regular listeners.

Broadcasting in Israel goes back to the days when the British ruled Palestine under a League of Nations mandate. They formed the Palestine Broadcasting Service (PBS) back in 1936 and put out programs in English, Hebrew, and Arabic. The present Kol Israel took its bow on the first day of Israel's independence, carrying Prime Minister David Ben-Gurion's original Declaration of Independence speech *live* on May 14, 1948, from the Tel Aviv Municipal Museum. The Hebrew broadcasting staff of the PBS joined up with those who had been broadcasting for the Jewish underground to form a nucleus for the original Kol Israel organization.

In 1965, a Broadcasting Authority Law was enacted that gave Kol Israel the same status that is enjoyed in Great Britain by the BBC. That is, it is administered by a Board of Governors acting as an independent body outside of direct government control. The executive head is the Director-General who is appointed by the government for a five-year term.

About two-thirds of the Israel Broadcasting Authority's budget is revenue from license fees of domestic listeners and TV viewers. The remainder comes from fees charged advertisers for commercials on domestic radio and TV. The External Service also gets direct grants from the government.

Kol Israel has a strong signal into North America with four 300-kW transmitters aimed at our shores. Broadcasts in English can be heard in the mornings, afternoons, and evenings. The last is the best time for reception, although afternoons generally also are good. Mornings at 1200-1230 GMT are usually not the best for reception.

In the evenings, listen from 0000 to 0030 GMT, 0100 to 0130 GMT, and 0200 to 0225 GMT on one of the following frequencies: 15.583 kHz, 11.640 kHz, or 9.815 kHz. Also listen from 0500 GMT to 0515 GMT on 15.105, 11.960, 11.638, or 9.815 kHz.

In the mornings at 1200, try for Kol Israel programs on 21.760, 21.495, or 17.612 kHz. Sometimes the reception at this hour is unusually good, but it is problematical, unlike the other times of broadcast.

From 2000 to 2030 GMT on 12.025, 11.960, 9.815, and 11.638 kHz, reception is usually strong. So, too, is it from 2230 to 2300 GMT on 11.960, 11.638, and 9.815 kHz.

All Kol Israel programs begin with a five-minute news summary and then go into their regular programming, which is different each day.

Sundays. "Calling All Listeners" is Radio Israel's popular DX program which gives up-to-date information on frequency changes for stations in the Middle East and also Kol Israel program details for the week. This program extends into Monday GMT times (0100, 0200, etc.).

Mondays. "Program Parade" gives forthcoming program details, and then comes "This Land," which is particularly aimed at people interested in touring Israel. Following this is "Spectrum," which reviews Israeli scientific developments.

Tuesday. "Israel Mosaic" gives the listener interesting facts about life in that country. "Pop Sound" offers music, and then comes "Personally Speaking," a program with guest commentators.

Wednesdays. "Israel Forum" is the big program of the day and offers the listener some lively discussions about people and politics.

Thursdays. "Time Out" offers interesting feature stories about life in Israel.

Fridays. "Music from Israel."

Saturdays. "Israel This Week" is a review of current events of the past six days.

Compared to Israel, the other Middle East broadcasters are, for the most part, inferior. While some have good signals, they are not on the air very much and their programming is, by comparison to Kol Israel, somewhat crude. However, if you are not listening just for enjoyment, as you might with the BBC or other Western stations, but to get information and various viewpoints, these other Middle East stations do give you that.

Radio Kuwait is an interesting station to listen to. This little country—about the size of Israel but with only half as many people—has some 15% of the world's oil reserves. Oil pays for just about everything there—free medical care, education, and social security. Best of all, there are no taxes!

Kuwait, as might be expected, has modern Western technology working for it, and this includes shortwave transmitters in which there are four 250-kW and two 500-kw units. They have a pretty good signal into the US from 1800 to 2100 GMT every day. They use only one frequency—11.675 kHz—but the equipment is good enough to make this almost always a good one for receivers here in this country.

A typical program from Kuwait goes like this:

—1800 GMT—Station Identification; music (Arab style);

—1830 GMT—15-minute talk on some current event in the Middle East by young lady;

—1845 GMT—More music;

—1900 GMT—Western-style music;

—1930 GMT—Review of the week;

—2000 GMT—Music (Arabic); and

—2030 GMT—Discussion of economics by a man.

Listening to Radio Kuwait is similar to sticking with Radio Cairo. It's not easy to stay glued to the receiver on stations like these unless something special is happening in the area. This, of course, is very likely these

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days, with the Middle East set to have an explosion of some kind at any time. Thus, it makes sense to know where to find stations like Radio Kuwait on your dial and to check into them from time to time.

A real disappointment is Saudi Arabia. Here is one of the largest Middle East countries, with a population of 9,290,000 and geographically a quarter the size of the US. Like Kuwait, it is oil-rich. Unlike Kuwait, which has a literacy rate of over 60%, Saudi Arabia has a rate of only 15%.

The Saudis have three shortwave transmitters—a 50-, a 100-, and a 350-kW. They should spend a couple of bucks and buy more or better ones. Reception is not very good here in the US. They broadcast from 1800-2100 GMT on 11.856 or 7.210 kHz.

When you do tune them in, the program starts with a man saying, "This is Radio Jeddah, the broadcasting service of the Kingdom of Saudi Arabia." The program that follows is a mixture of Middle Eastern music and talk, the latter primarily explaining positions on oil prices, purchases of modern arms from the US, etc. Again, while not the most entertaining station to listen to, it could be of great interest should some event take place in that part of the world.

A much more intriguing station to listen to is UAE Radio in Dubai, in the United Arab Emirates. Here is a little country that I had never heard of before becoming a shortwave radio listener. It has a population of less than a million people and is roughly the size of Maine. However, oil revenues give the UAE one of the highest per capita gross national products in the world. This little country was a British protectorate until 1971—another reason for its obscurity.

From a broadcasting standpoint, UAE Radio is a pleasant surprise. It has three 300-kW transmitters which seem to reach us here in North America extremely well. Its English programs can be heard twice daily, at 0330-0357 GMT on 17.775 and 9.590 kHz, and from 1610-1650 GMT on 21.695 and 17.710 kHz.

After station identification by a young lady who sounds as though she has been educated in London, England, UAE Radio offers not the news, as is the usual shortwave broadcasting technique, but a feature story. Recently, for example, it had an interesting 15-minute talk on the history of the trade of that geographical area with China during the time of the Crusades. Following this came ten minutes of music—not Arabic music, but the kind we hear on US FM "beautiful music" stations. After this came the news.

News is done in BBC style. That is, first they give you the headlines, then the detailed stories, and then a repeat of the headlines. You can see the British influence in their broadcasting. With the exception of Israel, UAE Radio appears to be the most westernized of all the Middle East stations.

Another pleasant surprise in Middle East stations is Radio Baghdad from Iraq. This station also has very good programs, and even though it is reported to have only a single 250-kW transmitter, it comes in with a pretty strong signal to North America. A typical program starts with 15 minutes of news followed by about five minutes of music (Arab style). Next comes a five-minute editorial (perhaps on the war with Iran and why they are fighting), followed by more music. Then another talk and more music.

While it may sound rather boring, the fact of the matter is that the talks are well thought out and very well delivered. It is good listening if you are at all interested in what is going on in the Middle East.

Iraq is not a large country (a little bigger than California in size and with a population of 12,000,000), but it is one of the key nations in the area and, unlike some, has a pretty good record for stability. In other words, its attitudes and thinking will be important in future developments in the Middle East. You can hear Radio Baghdad every day at 2130-2225 GMT on 9.745 kHz and at 0300-0335 on 21.585 kHz.

The other countries in the area are an "iffy" proposition as far as reception is concerned. Iran, three times the size of Iraq in both population and area, can often be heard at 1930-2030 GMT on 9.022 kHz. Programs are not exactly award winners, but you do get the Iranian point of view.

Afghanistan can usually be heard at 1900-1930 GMT on 15.077—but not very well. Algeria can sometimes be heard at 2100-2130 GMT on 25.700 or 15.215 kHz. Some listeners have heard Lebanon on 11.790 or 11.860 kHz at 0230-0300 GMT. DXers have caught additional Middle East countries, but not with programs in English.

However, for those of you who want to keep up with what is going on in that part of the world, you have a pretty wide choice of stations with good signals and fairly good programs—Israel, Egypt, UAE Radio, Kuwait, and Iraq. This assortment gives you a good balance of opinions. After a few months of listening to this array of programs, you'll be the best-informed guy or girl on the block about the Middle East. ■

John H. Klingelhoeffer WB4LNM
2608 Vantage Cove
Annapolis MD 21401

Are You Ready for 900 MHz?

This article is based on a paper given at the 27th Annual VHF Conference, Western Michigan University, Oct. 17, 1981, Kalamazoo MI.

Since the proposal and decision to allocate the 902-928-MHz segment of the UHF spectrum to the Amateur Service,[1] VHF/UHF enthusiasts and experimenters have wondered how best to utilize this new resource and what equipment would be needed to communicate efficiently on it. This article will address those topics and will propose a band plan for the amateur community based on experience with other VHF/UHF bands and proven radio-frequency design techniques.

History

Recent use of the frequency spectrum from 902-928 MHz in the United States has been for radio-frequency heating, i.e., the Industrial, Scientific and Medical (ISM) service. Early commercial and consumer microwave ovens used this wavelength, although most now have changed to 2450 MHz for improved performance at this higher frequency.[2] Most ISM heating devices (typically magnetrons) are tuned to a center frequency of 915 MHz and, with their pulsed power operation, generate considerable amounts of energy in the form of sidebands. Thus, guard bands of plus and minus 13 megahertz about the center frequency were adopted to minimize interference with services in immediately adjacent allocations.

Warning: The 915-MHz frequency was originally chosen for its heating effects on substances with high water content such as food and, unfortunately, human flesh!

The ISM service will share the new amateur allocation on a secondary, noninterference basis as the proposals now stand. Both services will share the band with Government Radiolocation (radar), which will have primary status (this is the case in many UHF/microwave amateur bands). In addition, other restrictions provide that the new band will not be available to the Amateur Satellite Service and that it may be susceptible to interference by Automatic Vehicle Monitoring (AVM) systems pending consideration by the Federal Communications Commission.[3]

Propagation

The new UHF allocation has shown in commercial land mobile tests that it behaves much as expected—attenuation by natural objects such as trees and earth will be greater than on 450 MHz, necessitating increased effective radiated power. However, in urban areas, because of the much shorter wavelength, its specular reflection allows much better coverage in areas forested by tall buildings and tunnel structures.[4]

Much research has already been accomplished by the commercial community in its quest to proliferate the cellular mobile radiotelephone services into the 825-to-890-MHz area. Several excellent articles have appeared documenting extensive tests that have been performed in a variety of areas (mostly metropolitan) around the United States.[5,6,7] The operational characteristics of amateur mobile FM voice should parallel these results quite closely.

One area of concern in using the new 33-centimeter band for mobile communication is the rate of signal cancellation and addition (mobile flutter). At two meters, the same phenomenon that causes lost words during transmissions will, at 900 MHz, add a low-frequency buzz to demodulated audio. At speeds of 30 to 60 miles per hour, the frequency of this tone will be approximately 80 to 160 Hz for a transmission frequency of 915 MHz. Although this is not a problem for voice intelligibility (it can be filtered out by appropriate audio high-pass filtering), it does cause the present continuous tone subaudible squelch (CTSS), known more popularly by its trade name, Private Line,[8] to malfunction by unsquelching a receiver when there is actually no transmitted CTSS tone. Thus, different selective-signaling methods, perhaps tone burst or digital squelch composed of a short duration serial-bit stream at the beginning of each transmission, would be required for reliable operation.

902.0 MHz—CW/SSB
902.6 MHz—FM voice/RPT
(mobile receive, RPT transmit)
906.0 MHz—ATV Channel A
912.0 MHz—ATV Channel B
918.0 MHz—ATV Channel C
924.0 MHz—FM voice/RPT
(mobile transmit, RPT receive)
927.4 MHz,
928.0 MHz—Control Links, Packet Transmissions

The band plan proposed by WB4LNM in October, 1981, for 902-928 MHz.

Hardware

Equipment for communicating at 900 MHz is another area where the commercial communications services are helping almost as much as when they dumped thousands of old VHF high-band transceivers on the amateur market in the late 1960s. Although it will be many years before the new cellular radios will be available as surplus, the components and technology used in these transceivers will be produced in mass quantities for the many tens of thousands of

mobile radiotelephone users that are expected to populate the adjacent commercial band in the next few years. Several semiconductor manufacturers already are producing components that will work well in amateur transceivers.[9,10,11]

For those who don't want to build down to the basics, there are also hybrid power-amplifier modules that require little more than application of proper drive signals, power-supply voltages, and heat sinking.[12] These would be suitable for FM, PM, or CW operations, and require only 250 milliwatts of input energy for 7.5 or 20 Watts output.

Receiver designs will be of the same general superheterodyne style we are accustomed to, but with significant differences in the construction of the rf amplifier and first mixer stages. To enhance selectivity, small cavity resonators or helical resonators will be used for their low-loss characteristics and their physical size, which will reach manageable proportions at this wavelength. Gallium arsenide field-effect transistors, once expensive devices for commercial and military systems, will be employed to minimize noise figures when used ahead of Schottky diode double-balanced mixers known for their inherent excellent wide dynamic range. The cost of these mixers continues to decrease as they are used in more and more communication systems. Several manufacturers already offer, in small quantities, preassembled mixer modules that work to 1 GHz for under ten dollars.

Building at 900 MHz will introduce the newcomer to a different attitude toward the components he uses. The rules here are, "the only good leads are no leads," and, "it may look like a capacitor to you but what does it look like to the circuit?" At this frequency, a one-eighth-inch lead of #22 AWG wire on a 270-picofarad disc capacitor exhibits an inductive reactance larger than the capacitive reactance of the capacitor. Thus, the capacitor at this frequency is actually acting as an inductor.

Chip capacitors, capacitors with no leads at all, are frequently used where this effect becomes a problem. Although they are reasonably expensive, their price can be expected to decrease since the production process for manufacturing them is automated and they are now being used in the computer industry to help digital devices comply with stringent new radio frequency interference regulations.

One of the toughest problems to tackle will be that of frequency stability, especially in mobile and portable equipment. Consider a typical transmitter crystal of frequency 33.4074 MHz (902 MHz divided by 27), with a tolerance of 0.001% over the extremes of temperature, shock, and voltage. This crystal could exhibit a drift of 9 kHz at 902 MHz and still be within specification. If the new amateur band were to follow the normal 25-kHz channel spacing and 13-kHz occupied bandwidth used on 450 MHz, it is obvious that the communications system would suffer great degradation in both adjacent channel selectivity and demodulation distortion if this crystal were used.

Several ingenious ideas have been proposed to alleviate this stability problem, or at least to transfer the problem to a station capable of maintaining an accurate frequency standard.[13] If the mobile transmitters were designed to operate in full duplex mode, the signal received from the repeater (assumed to be stable and accurate) could be used as a reference to which the mobile transmitter could be frequency-locked. Since the vast majority of vehicular operation on this band will most certainly be tied to repeater systems, this method represents a very cost-effective solution. The band plan suggested later in this article was developed with this concept in mind.

Another positive aspect of a full duplex system is that it will allow the operator to gain immediate knowledge of how well he is communicating with the retransmission site, because he will be able to listen to his own signal as it is retransmitted (perhaps at reduced volume in the receiver to prevent audio feedback).

Antennas for the 33-cm band will be small enough to be built easily with simple hand tools and mounted on masts no larger than small television antennas. A fourteen-element parasitic yagi-uda array, which magnifies a transmitter's power 16 times, occupies a space of only 6.5 by 28.5 inches. Corner reflectors, which have never been widely used by amateurs at lower frequencies, are easily constructed and offer a decent amount of gain and fairly wide bandwidth. Of course, for those who can afford the price (and have no neighbors), a four-meter diameter parabolic dish gives about 27 dB gain and can be used on the higher microwave bands as well.

Using It

Many different ideas, amateur conventions, and technological factors were considered when attempting to formulate a band plan that would serve all the needs of the amateur fraternity. The following plan is the distillate of those components.

One aspect of the hobby that appears to be in a growth mode is that of fast-scan television and computer-generated video. On the 70-centimeter band, the wide, buzzing video carriers are not well received (more accurately, not welcome) near the weak-signal satellite downlink subband from 435-438 MHz. This has prompted ATV, in several metropolitan areas of the country, to move to 23 cm in search of usable spectrum. However, the expected allocation of 1260-1270 MHz to the amateur satellite service,[1] coupled with the recent removal of amateur operating privileges from 1215 to 1240 MHz for military navigational satellite systems (NAVSTAR, GPSS),[3] as well as the difficulty of generating healthy amounts of power at 23 cm, makes this band less than desirable for fast-scan television.

I am proposing, therefore, that three 6-MHz-wide standard video channels (with multiplexed FM voice if desired) be centered in the proposed band plan. Since these three channels would be broadcast standard video format and frequency spacing, only one local oscillator per downconverter would be needed to mix all three down to contiguous VHF or UHF broadcast channels for display on a standard unmodified television receiver.

For the FM crowd, the band plan proposes 128 new FM channel pairs spaced at 25 kHz, with the transmission and reception frequency difference (split) at 21.4 MHz. This would allow use of relatively inexpensive monolithic crystal filters at an intermediate frequency of 21.4 MHz and the frequency-locking of transmitters to received pilot carriers from repeaters. Although this is an extremely low first i-f for a radio of this type, a judicious mix of image-cancelling mixer technology and low-loss

front-end filtering will provide good image rejection and sensitivity.

The portable equipment receive band is placed at the low end of the new spectrum, causing the image frequencies to be thrown into the avionics (DME, TACAN) band instead of the new cellular radiotelephone band. Since the smaller mobile transceivers have less room for cavity filters, that can be implemented more easily in fixed-retransmission sites. The ATV repeater-output spectrum is also located at the same end of the band as the FM voice repeater so that the two types of repeaters can be easily co-located. Point-to-point service for low-band repeater linking, packet-transmission techniques, and radio-command systems would be placed at the high end of the band.

Space has been reserved at the lower end of the band for weak-signal modes, SSB, and CW, as is common on the lower VHF and UHF bands. This 600-kHz swath allows for many 3-kHz sideband voice channels for tropospheric-scatter, moonbounce, and meteor-scatter experiments. Initial experiments may be carried out with little more than a returned 451-451.30-MHz commercial FM transceiver driving a varactor doubler for CW transmission. From past experience with both listening and operating on the other bands above 30 MHz, this will provide plenty of weak-signal spectrum space for the foreseeable future.

Conclusion

Techniques and equipment for the new amateur band from 902-928 MHz have been discussed. A band plan which tries to serve all users in the amateur community has been proposed. Particular emphasis has been placed on the need for fast-scan television transmission spectrum since it appears that ATV mode has been nudged out of other regions of the amateur spectrum. It is hoped that the discussion of the new UHF band will entice you to build or buy equipment and operate this frequency range no matter what your special interest is. With 26 MHz of spectrum, there is room for everybody! ■

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Crime-Stoppers' Textbook

—rules of thumb for would-be gumshoes

Robert C. Diefenbach
2402 Lauderdale Drive, NE
Atlanta GA 30345

No one seemed to notice the tan car that stopped at the quiet corner only long enough to drop off a tall, casually dressed young man. As the car drove unhurriedly away, the young man began walking past the neatly trimmed yards looking—carefully looking—at each house as he passed. No one seemed to notice.

But the driver of the car with amateur radio tags did notice, and a few minutes later also noticed the same tan car stopped in the shade of a clump of low pine trees in a nearby church parking lot. The car's hood was raised. Its driver, standing in front with one foot resting on the bumper, was making some unseen adjustment to the idling engine. He appeared impatient as he glanced at his wristwatch.

B.M. Gray II.

Driving past the parking lot, the ham noted the dented left front fender on the tan car and the driver's blonde hair and blue football-style jersey. And more. By the time he pulled his car to an easy stop midway down the next block and reached for the microphone clipped to the dashboard, he knew exactly what he would say to the police dispatcher.

It took only moments to place the call through the repeater phone patch.

The dispatcher's voice was crisp. "Police emergency."

"I want to report a suspicious car and persons on Thomason Drive. I suspect they are planning a burglary."

"Stand by."

There was nothing remarkable about this series of transmissions or others like it, heard infrequently on the amateur and business radio bands, except that they are heard *very* infrequently in proportion to the potential criminal activities witnessed by drivers of radio-equipped vehicles. Law-enforcement agencies wish fervently that there were more civilian radio exchanges like this one. They need all the help they can get.

There are only 2.1 full-time law-enforcement officers per 1000 US citizens, according to the latest figures released by the Federal Bureau of Investigation. These men and women do their best in the face of an alarming increase in serious crime, but they are, as a group, vastly overworked. Since 1971, property crimes (burglary, larceny-theft, and motor-vehicle theft) have shot up 54 percent nationally. Violent crimes (murder, forcible rape, and aggravated assault) have risen 60 percent. In just one year, from 1979 to 1980, burglaries and robberies rose 14 and 18 percent, respectively.

As federal, state, and local governments tighten their belts in the current wave of budget and tax revisions, there is not likely to be much—if any—increase in the number of professional crime fighters in most jurisdictions. There is a clear and growing need for appropriately-controlled civilian involvement.

Special Agent Edward J. Tully of the FBI points out that "there has been a tendency for civilians to forget their responsibility for effective law enforcement. Clearly, police departments cannot do the job alone." Tully is acting academic dean of the FBI Institute in Quantico, Virginia, where police officers from cities of all sizes are trained alongside federal and state agents and policemen and -women. "Citizens with access to mobile two-way

radios, or ham radio opertors, can be of significant assistance," he said.

Sanford H. Smith, a leading national figure in public-safety communications, agrees wholeheartedly. "The present trend in our country is towards self-help. Increased citizen involvement in law enforcement is a natural part of that trend." Mr. Smith is Director of Communications for the city of Greensboro, North Carolina, president of the Land Mobile Communications Council, and immediate past-president of the Associated Public Safety Communications Officers, Inc. "When we feel we have done something for our community and our fellow men, there is a huge personal reward," he adds.

When the FBI and any other law-enforcement agency solicit civilian help, they are definitely not suggesting that the civilians "play policeman." That is the very last thing authorities want and is probably the best way a civilian could pick to become a part of the *problem* instead of the *solution*! What is wanted and needed is responsible, reliable observation and reporting of potential or actual criminal activities, and NOT vigilantism or other unauthorized direct involvement.

Professionals in law-enforcement communications—"sworn" officers and civilians alike—agree that radio-equipped volunteer observers' reports are valuable. They stress that these reports are more valuable when the observers have been trained, even minimally, by their local police departments.

The concept is endorsed by The Crime Prevention Coalition, a group of almost 50 prestigious national organizations whose combined efforts are behind the multimillion dollar "Take a Bite Out of Crime" advertising campaign. B.M. Gray II, Director of Crime Prevention, says, "Surveillance by drivers of two-way radio-equipped vehicles could be one of the most useful citizen involvements in preventing crimes, particularly street crimes, from occurring. Drivers whose radios give them the ability to notify and communicate with the police without leaving their vehicles—whether amateur radio hobbyists or commercial drivers—can be a definite asset."

Why the need for training? It sounds simple enough: If you see something unusual or suspicious, call the police. That's the basic idea, all right. But when *is* something unusual or suspicious? *What* should be reported. *How* should it be reported? Police-directed training is the most reliable source for answers specific to each community's needs and resources.

Most police departments are anxious to work with local citizens who express interest in helping them. A letter to the office of the Chief of Police, volunteering to help and asking to be trained, is a good way to start. You might attach a copy of this article as a way of introducing the subject.

The amount of training police departments can provide—from informal advice through classroom presentations—varies widely, depending upon the resources available. Understandably, most departments will devote more attention to training requests that represent bigger potential payoffs—larger numbers of reliable radio-equipped observers on the streets. Several ham radio clubs or repeater groups, or the owners of several smaller firms which operate radio-equipped vehicles, can effectively combine their initial contacts with the police.

Sanford H. Smith.

What Is Unusual or Suspicious?

Deciding what is unusual or suspicious enough to report to the police calls for subjective, case-by-case judgment. It is easy to err in either direction: reporting inconsequential observations or failing to report meaningful ones. Detective Jerry Jaquenta KA4NIA of the Boca Raton, Florida, Police Department burglary squad, voices the opinion of most law-enforcement professionals. "We would far rather get a dozen or more false alarms—calls reporting what turn out to be entirely innocent events—than risk missing the one call that does involve crime. If there is reasonable doubt, *call!*"

Detective Jaquenta lists these examples among observations he thinks should be reported: persons—such as obviously truant students—who are obviously out of place where they are observed, perhaps with a screwdriver or gloves sticking out of a pocket, someone knocking at the front door and moving to the rear of a house when there is no answer, and occupied cars or trucks parked in concealment.

"But don't be guided only by a person's appearance," cautions Sanford Smith. "It is a subject's *actions* that will usually tip off a good observer." Persons who seem to be hiding, or showing nervousness while loitering, are high on Smith's list of significant observations.

"Any sort of violence should be reported quickly," adds David N. Wise N8CNY, veteran chief of the Michigan State Police Department's twenty-

David N. Wise N8CNY.

seven communications dispatching locations. "Whether it is as obviously criminal as a robbery or only potentially so—as in a street-corner shoving match that looks as if it could become a fistfight—let the police know. But," he emphasizes, "do it from a safe distance!" Exposing yourself to danger or violating the law yourself—for example, following a speeding car—isn't just foolhardy. It is dumb!

Police dispatchers, particularly in smaller jurisdictions, soon learn whether regular callers are reliable observers or merely busybodies. If you remember the old tale about crying wolf, you will agree that it is best not to get the latter reputation.

What Should Be Reported?

Public-safety communications expert Sanford Smith lists these four components of an observation report, in the order in which they should be given to a police dispatcher.

- *What is being reported?* Tell the dispatcher immediately. A robbery in progress? A suspicious person or vehicle? An accident? A fire? A potential suicide? Knowing what the basic problem is, the dispatcher can decide what public-safety resources may be needed. Radio operators should know that most police departments would rather get several radio reports of a serious traffic accident than not receive any because each passing radio-equipped observer assumed someone else had reported it.
- *Where is it happening?* Give as accurate a location as possible. Include street names, nearby intersections, building numbers, and easily-recognized landmarks.
- *Who and where are you?* The radio or telephone link between you and the police could somehow be broken. Give the police dispatcher your name, exact location, and a way that he or she can get back in touch with you if you are disconnected. This is especially important in bigger cities where several dispatchers are on duty at a time. Calling back after disconnecting, you may get another dispatcher and have to start your report all over again.

Ham radio operators, and others who can talk to the police directly through repeater phone-patch facilities, are not so easily recontacted if the patch times out or the connection breaks some other way. Hams should ask for help from another amateur monitoring the frequency from a location with a telephone, and that telephone number should be given to the police dispatcher. If no one else is on frequency, think of some other way the communications link might be re-established if it breaks. Be sure that you and the police department both understand how the recontact will be made.

If the report is being made through a taxi, delivery service, or other business radio dispatcher, that business dispatcher's phone number should be given to the police dispatcher.

Some law-enforcement agencies will insist on recording your identity—as much to discourage anonymous nuisance calls as to add to their record. Others will ask your name, but treat your report with equal seriousness whether you give it or not. While some radio operators may shrink from getting involved in an incident they observe by identifying themselves, they should realize that by giving their names they are assuring the police that they believe in the accuracy of their report.

- *What are the details?* Your eyes may fool you. Simply being able to see all of the details that occur during an exciting, stressful event can be difficult. Under these circumstances we are all subject to a physical phenomenon called tunnel vision. As we concentrate intently on what is going on in the center of our visual field, we actually lose a great percentage of our peripheral—or side—vision. Being aware that this may happen to you will help you prepare to overcome tunnel vision by making a conscious effort to look *around* the central action for important details.

When describing persons, follow this standard sequence. Leave out any item you do not know.

1. Name
2. Sex
3. Race
4. Age
5. Height
6. Weight
7. Hair
8. Eyes
9. Complexion
10. Physical characteristics: marks, scars, limp, etc.
11. Clothing, from head to foot: hat, shirt, coat, trousers, socks, shoes.

When describing vehicles, start with the color or colors, then give the make, model, and as many give-away markings—accessories, damage, etc.—as you can. The license number or any part of the number can be very helpful to the police. But stolen tags are commonly used by criminals, so an accurate description of the vehicle itself is just as important.

How Should It Be Reported?

To be useful, reports must be made calmly, clearly, and objectively. That may not seem too difficult when you are describ-

Legal Issues In Civilian Surveillance

Does a radio operator step onto dangerous legal ground by making reports to the police? Can he or she be sued for slander? For false arrest? Not if the reports are *accurate*, according to Lewis J. Paper, former Associate Counsel of the Federal Communications Commission, now in private practice in Washington, DC. "It would be difficult," he says, "to conceive a situation where simply reporting—*accurately* reporting—what is observed could expose the observer to any liability."

Attorney Paper recommends that as soon as possible after making any direct or indirect verbal report to the police, radio-equipped observers should make a personal written record of everything seen and said concerning the event, and then save the record. If made while memory is still fresh, this document can be very helpful later if you are ever called as a witness in any court action that ensues. You can be subpoenaed by either the prosecution or defense. Your record itself will probably never be called into evidence. But if there is—and there frequently is—a long delay between the event and a trial, it will protect you against a lessening or loss of memory that could occur before you are asked to testify.

"Although most states' slander laws vary in detail," says Mr. Paper, "generally a charge of slander must be based on reporting information which the reporter *knows or should have known* was false. A written record—by its very existence—will help minimize any risk that you will be accused of intentionally lying."

Provided you have accurately reported your observations, according to Mr. Paper, you have no liability if the police are charged with false arrest after detaining someone as a result of your report. "In making the arrest the law-enforcement agency assumes the responsibility and any liability for that arrest," he says.

Like every other authority contacted in connection with this article, Mr. Paper quickly and firmly points out that volunteers must remember that they can expose themselves to liability for violations like trespass and assault by acting as if they have powers which, *without specific legal authority*, they don't have! ■

Detective Jerry Jaquenta KA4NIA

ing a minor auto accident on the freeway. But it *is* difficult when actual crime or violence is concerned. Even police officers have had difficulty making proper radio transmissions under emotionally stressful circumstances. Here are some tips from the experts:

- Think about what you are going to say before you transmit. Even if it means a short delay, compose your message mentally to be sure it is accurate, concise, and in the sequence that will be the most helpful to the police dispatcher.
- Keep your transmissions short. Break frequently to allow the person on the other end to interrupt.
- Control your voice. When excited or upset, many people tend to speak faster and to raise the volume and pitch of their voices. The combination makes for hard-to-copy radio transmissions. Listen to yourself. Keep your voice as close to normal as possible.
- Avoid subjective words. Be specific in describing what you see. The dispatcher doesn't know what you think "a bad fight" is or what "a whole bunch" of injured motorists means.
- Speak plain English! Leave the "ten-this" and "ten-that" and other supposed-to-be police jargon to the TV heros. The few seconds you think you might save by using jargon is not worth the risk of being misunderstood.
- Stay at your radio. Except to render whatever aid you can to an injured person, you can be more helpful by being keeping a communications line open between the police and whatever action you are observing.

Don't forget the important don'ts: *Don't* expose yourself to danger! *Don't* play cop! In the process of trying to assist the police, *don't* violate any laws yourself. ■

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SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received at 73 Magazine by the first of the month, two months prior to the month in which the event takes place.

SEASIDE OR
JUN 4-6

The North Coast Repeater Association and the Oregon Tualatin Valley Amateur Radio Club will hold their Oregon State Ham Convention on June 4-6, 1982, at the Seaside Convention Center, Seaside OR. Hours are 12:00 noon to 5:00 pm on Friday, 8:00 am to 9:30 pm on Saturday, and 8:00 am to 2:00 pm on Sunday. Registration is $5.00 per single, $7.00 per couple, and $1.00 for children. Seminars will include receiver design, construction, satellite earth stations, contests, and many others. The banquet speaker will be a NASA Space Shuttle astronaut and master of ceremonies will be Mel Ellis K7AOZ, Vice Director, ARRL Northwest Division. The banquet cost is $12.50 per person. Talk-in on 146.52 and 145.45 (−600). For more information, write Doc McLendon W7GWC, PO Box 920, Seaside OR 97132.

SAN DIEGO CA
JUN 4-6

The San Diego County Amateur Radio Council and the San Diego Computer Society will hold Hamcomp 82 on June 4-6, 1982, at the Town & Country Convention Center, San Diego CA. Registration is $7.00 and the Saturday evening banquet featuring speaker Roy Neal K6DUE is $15.00. There will be technical sessions all day Saturday, ham and computer booths, many prizes and awards (including a main prize of an Osborne 1 computer), an ARRL forum, a ladies' luncheon, Sunday morning breakfasts, and ham and computer sessions every hour. The final event on Sunday at 1:00 pm will be a T-hunt on 146.76 MHz. Talk-in on .04/.64, .75/.15, and 222.94/224.54. For registration forms, write Hamcomp 82, PO Box 81537, San Diego CA 92138.

LOVELAND CO
JUN 5

The Northern Colorado Amateur Radio Club will hold its annual Superfest on June 5, 1982, from 8:00 am to 4:30 pm in the McMillen Building at the Larimer County Fairgrounds, Loveland CO. Admission is $3.00 and will include a swap table. There will be exhibits, technical talks, a code contest with prizes, an auction, a swapfest, and drawings for many prizes, including a synthesized 2-meter handheld. Special activities are planned for non-hams, especially the kids. For further information, contact Gene Bellamy WD0DRM, 3124 West 6th Street, Greeley CO 80631.

ST PAUL MN
JUN 5

The North Area Repeater Association will hold a swapfest and exposition for radio amateurs and computer hobbyists on June 5, 1982, at the Minnesota State Fairgrounds, St. Paul MN. Admission is $3.00 and free overnight parking for self-contained campers will be available on June 4th. There will be exhibits, booths, and prizes. Talk-in on .25/.85 and .16/.76. For more information or reservations, write Amateur Fair, PO Box 30054, St. Paul MN 55175.

GRAND RAPIDS MI
JUN 5

The Independent Repeater Association will hold its annual Grand Rapids Festival Swap & Shop on Saturday, June 5, 1982, from 8:00 am to 3:00 pm at the Kentwood Field House, just south of 60th Street on Kalamazoo Avenue. Admission is $3.00; eight-foot tables are $7.00 or $4.00 for half-size. There will be prizes and refreshments. For more information or dealer reservations, write IRA Swap, 562 92nd Street SE, Byron Center MI 49315, or call (616)-455-2926.

GUELPH ONT CAN
JUN 5

The Guelph Amateur Radio Club (VE3ZM) will hold the 7th annual Central Ontario Amateur Radio Flea Market on Saturday, June 5, 1982, from 8:00 am to 4:00 pm at "Regal Hall," 340 Woodlawn Road West, corner of Woodlawn and Hanlon Parkway (Hwy. #6), Guelph ONT. Admission is $2.00 and children 12 years old and under will be admitted free. Vendors' admission is an additional $3.00 and a quantity of 3' x 8' tables are available at $5.00 each. Vendors will be admitted from 6:00 am on. There will be commercial displays, surplus dealers, computer software and hardware, and indoor and outdoor displays. The refreshment concession will open at 12:00 noon. For further information, contact Bob Lacombe VE81YE at (519)-843-4618 or Rocco Furfaro VE3HGZ at (519)-824-1157.

FAIRBANKS AK
JUN 5

The Arctic Radio Club of Fairbanks AK will hold a hamfest on June 5, 1982, at the Kiwanis AG Hall at the Tanana Valley Fairgrounds. The doors will open at 8:00 am and there will be a $5.00 fee for all sellers. Features will include door prizes, a raffle, a left-footed key for a code contest, and an ole'-fashioned pot luck dinner. The Alaska QSL bureau will be there as well as an ARRL representative. For further information, contact Herb Walls KL7JLF, PO Box 1625, Fairbanks AK 99707.

CHELSEA MI
JUN 6

The Chelsea Swap and Shop will be held on Sunday, June 6, 1982, at the Chelsea Fairgrounds, Chelsea MI. Gates will open for sellers at 5:00 am and for the public from 8:00 am until 2:00 pm. Donation is $2.00 in advance or $2.50 at the gate. Children under 12 and non-ham spouses will be admitted free. Talk-in on 146.520 simplex and 147.855 (Chelsea repeater). For more info, write to William Altenberndt WB8HSN, 3132 Timberline, Jackson MI 49201.

MANASSAS VA
JUN 6

The Ole Virginia Hams Amateur Radio Club, Inc., will hold the eighth annual Manassas Hamfest on Sunday, June 6, 1982, at the Prince William County Fairgrounds, Route 234, Manassas VA. Admission is $4.00 per person; children under 12 will be admitted free. Gates will open at 8:00 am. In addition to the admission fee, there will be a $3.00 fee for tailgating and the flea market spaces. Gates will open at 7:00 am for tailgating setup. Features will include ladies' programs, children's entertainment, CW proficiency awards, QSL bureaus, food and refreshments, and many prizes. Talk-in on 146.37/146.97 (W1CRO) and 146.52. For additional information, write Jim Lascaris WA2QEJ, 11053 Camfield Ct., Manassas VA 22110.

MILTON PA
JUN 6

The 11th annual Milton Amateur Radio Club hamfest will be held on June 6, 1982, from 8:00 am to 5:00 pm, rain or shine, at the Allenwood Firemen's Fairgrounds located on US 15, 4 miles north of Interstate 80. Advance registration is $2.50; at the gate, $3.00; XYLs and children will be admitted free. There will be a flea market, an auction, contests, cash door prizes, and a free portables and mobile FM clinic. An indoor area will be available as well as food and beverages. Talk-in on .37/.97, .025/.625, and .52. For further details, contact Jerry Williamson WA3SXQ, 10 Old Farm Lane, Milton PA 17847, or call (717)-742-3027.

ROME NY
JUN 6

The Rome Radio Club, Inc., will hold the 30th annual Rome Ham Family Day on Sunday, June 6, 1982, at Beck's Grove, Oswego Road, Rome NY. Features will include door prizes, an early brunch, a buffet-style dinner, a flea market, educational and scientific presentations, and overnight parking for campers, as well as fly-in capabilities. Talk-in on .28/.88 and 146.55.

HUMBOLDT TN
JUN 6

The Humboldt Amateur Radio Club will hold its annual hamfest on Sunday, June 6, 1982, at a new location: Bailey Park, North 22nd Avenue, Humboldt TN. Tickets are $2.00 each, with no additional charge for the flea market. There will be prizes, light lunches, and ladies' and children's activities. Talk-in on 146.37/.97. For more information, contact Ed Holmes W4IGW, 501 North 18th Avenue, Humboldt TN 38343.

DEAL NJ
JUN 6

The Fort Monmouth ARC and Haverim will hold the Jersey Shore Hamfest and Electronics Flea Market on June 6, 1982, from 9:00 am to 4:00 pm at the Jewish Community Center, 100 Grand Avenue, Deal NJ. Admission is $3.00 per person; XYLs and children under 12 will be admitted free. Outdoor tailgating is $2.00 per space and indoor space is $5.00 per 8-foot table. Door prizes and refreshments will be available. Talk-in on 147.045 + .6, 146.775 − .6, and 146.52.

MAYVILLE ND
JUN 6

The Goose River Amateur Radio Club will hold its annual hamfest on Sunday, June 6, 1982, at the city park, Mayville ND. In case of inclement weather, the festivities will be held in the Mayville Armory. Registration begins at noon and the charge is $1.00. All registrants will be eligible for the many door prizes. The grand prize is a Heathkit SA2060 Super Tuner. Camping facilities will be available for those who desire to beat the rush. Talk-in on .31/.91. For further information, please contact Mary Carlson, RR 2, Box 47, Hatton ND 58240.

MIDLAND MI
JUN 12

The Central Michigan Amateur Repeater Association will hold its eighth annual hamfest on June 12, 1982, from 8:00 am to 4:00 pm in the "Great Hall" of the Valley Plaza Complex, just off US Rte. 10 in Midland MI. Tickets are $3.00; children under 12 will be admitted free. Talk-in on 146.67/.07 and 146.52. For additional information, contact Carol Hall WD8DQG, 4651 Cardinal Drive, Mt. Pleasant MI 48858, or call (517)-772-0363.

STATEN ISLAND NY
JUN 12

The Staten Island Amateur Radio Association will hold its flea market on June 12, 1982, from 9:00 am to 3:00 pm, at All Saints Episcopal Church, Staten Island NY. To get to the church, take Interstate 278 to the Victory Boulevard exit, proceed east on Victory Boulevard for ⅓ mile to Crystal Avenue, and turn left on Crystal Avenue. There will be no admission charge for buyers, a $3.00 per space charge for sellers (bring your own tables), and a $1.00 charge for electricity. Refreshments will be available. A raffle will be held at 1:00 pm and the winner will have a choice of an Icom IC-4AT or a Bearcat 20/20. Talk-in on 146.52 and 146.28/.88. For additional information, send an SASE to George Rice, Jr. WA2AMJ, 480 Jewett Avenue, Staten Island NY 10302.

TORRINGTON CT
JUN 12

The CQ Amateur Radio Club of Torrington CT will hold a ham radio flea market on June 12, 1982, from 9:00 am to 5:00 pm at the Drop-In Center, East Albert Street, Torrington CT. The admission fee of $2.00 includes a chance for a door prize. A seller's indoor table is $5.00 each and tailgating space is $2.00 each. There will be a raffle featuring a personal microcomputer kit as first prize, a portable radio cassette recorder as second prize, and an MFJ clock as third prize. You need not be present to win. Talk-in on 146.25/.85, 147.84/.24, and 146.52. For tickets, table reservations (before June 8, 1982), or more information, contact Sebastiano Albani KA1FVM, 76 Pythian Avenue, Torrington CT, or call (203)-489-2945; Ron Brook KA1AFN, 213 East Pearl Street, Torrington CT, or call (203)-482-2764; or the CQ Club, PO Box 692, Torrington CT 06790.

GRANITE CITY IL
JUN 13

The 53rd year anniversary celebration and annual hamfest of the Egyptian Radio Club, Inc. (W9AIU), will be held on Sunday, June 13, 1982, at their club grounds near Granite City IL.

QUEENS NY
JUN 13

The Hall of Science Amateur Radio Club will hold its annual indoor/outdoor, rain-or-shine hamfest on Sunday, June 13, 1982, from 9:00 am to 4:00 pm, at the municipal parking lot, 80-25 126th Street (1 block from Queens Boulevard), Kew Gardens, Queens NY. Sellers' donations are $3.00, buyers' donations are $2.00, and XYLs and children will be admitted free. Talk-in on 145.520. For additional information, contact Thomas Doyle KA2DTB, 135-14 125th Street, South Ozone Park, Queens NY 11420, or phone (212)-738-8887.

WILLOW SPRINGS IL
JUN 13

The Six Meter Club of Chicago, Inc., will hold its 25th annual ARRL-affiliated hamfest on Sunday, June 13, 1982, at Santa Fe Park, 91st and Wolf Road, Willow Springs IL (southwest of downtown Chicago). Ad-

vance registration is $2.00; at the gate, $3.00. There will be a large swapper's row, displays, an AFMARS meeting, refreshments, plenty of parking space, picnic grounds, and prizes, including a first prize of a color TV. Talk-in on 146.52 or .37/.97 K9ONA/R. For advance tickets, contact Val Hellwig K9ZWV, 3420 South 60th Court, Cicero IL 60650.

SANTA MARIA CA
JUN 13

The Satellite Amateur Radio Club will hold its annual bar-b-q/swapfest on June 13, 1982, at the Union Oil picnic grounds, just south of Santa Maria CA. Admission is free for the swapfest; dinner tickets are $7.50 for adults and $3.50 for children 6 to 12 years of age; prize tickets are $1.00 each. Swap tables are $2.50 for each area. There will be prizes, contests, and a Santa-Maria-style bar-b-q. Talk-in on 146.34/.94. For tickets or more information, write Santa Maria Swapfest, PO Box 2616, Orcutt CA 93455.

BELLEFOUNTAINE OH
JUN 13

The Champaign Logan Amateur Radio Club, Inc., annual hamfest and flea market will be held on Sunday, June 13, 1982, at the Logan County Fairgrounds, Bellefountaine OH. Tickets are $1.50 in advance and $2.00 at the door. Tables are $3.00 in advance. Gates will open at 7:00 am and prize drawings will be held every hour starting at 9:00 am. The major prizes of $200, $100, and $50 will be drawn at 3:00 pm; you need not be present to win. Talk-in on 147.60/.00 W8EBG/R. For more information, tickets, or tables, contact M. A. (Bud) Griswold W8JXM, PO Box 301, Urbana OH 43078.

HUNTINGTON WV
JUN 13

The Tri-State Amateur Radio Association will hold its 20th annual Huntington Hamfest on Sunday, June 13, 1982, from 9:00 am to 3:00 pm at Camden Park, off Route 60 West, Huntington WV. Registration is $3.00 per person and children under 12 will be admitted free. Spaces are $3.00 each for the flea market and 6-foot commercial dealers' tables are $5.00 each. Setup time is 6:00 am to 9:00 am. Overnight space will be available for self-contained RVs. Talk-in on 146.04/.64 and 146.52/.52. For further information, send an SASE to TARA, Inc., PO Box 4100, Huntington WV 25729.

SAGINAW MI
JUN 13

The Saginaw Valley Amateur Radio Association will hold its new Electronic Hobby Expo on Sunday, June 13, 1982, at Bridgeport High School, off I-75, exit 144 west. Doors will open at 8:00 am. Adults' tickets are $1.00; kids will be admitted free. Trunk sales are $2.00 and all tables are $5.00. Features will include displays and demonstrations for the whole family, major prizes totaling $400.00, and hourly drawings. Talk-in on 147.24 and 146.52 (K8DAC). For more information, table reservations, or tickets, send an SASE to SVARA/EHE-82, 50 Durand Court, Saginaw MI 48602.

MONROE MI
JUN 13

The annual Monroe County Radio Communications Hamfest will be held on June 13, 1982, from 8:00 am to 3:00 pm at the Monroe Community College, Raisinville Road, Monroe MI. Tickets are $2.00 at the gate, $1.50 in advance, and XYLs and children will be admitted free. Plenty of table space and free parking will be available. Featured will be contests, auctions, and displays. Talk-in on 146.13/.73 and .52. For additional information, contact Fred Lux WD8ITZ, PO Box 982, Monroe MI 48161, or call (313)-243-1088.

AKRON OH
JUN 13

The 15th annual Goodyear ARC Hamfest will be held on Sunday, June 13, 1982, from 10:00 am to 5:00 pm at Goodyear Wingfoot Lake Park, near SR224 and 43, east of Akron OH. Family admission is $2.50 in advance and $3.00 at the gate. Flea market spaces outside are $1.00 and dealers' tables inside the shelter are $5.00 (advance reservations are suggested). There will be picnic tables, a concession stand, and free parking available. Prize drawings will be held throughout the day with grand prize drawings at 4:00 pm. Talk-in on 146.04/.64. For further information, advance sales tickets, and shelter house reservations, send an SASE to Don Rogers WA8SXJ, 161 S. Hawkins Avenue, Akron OH 44313.

PHILADELPHIA PA
JUN 14

The Phil-Mont Mobile Radio Club will host the amateur radio segment of the International Conference on Communications on Monday, June 14, 1982, from 7:00 pm to 10:00 pm, at the Franklin Plaza Hotel, 17th and Race Streets, Philadelphia PA. The session is free and all radio amateurs are invited to attend. For additional information, contact Jacob S. Kovalchek, Jr. AK2I, 1228 Heartwood Drive, Cherry Hill NJ 08003, or phone (603)-428-5924.

DUNELLEN NJ
JUN 19

The Raritan Valley Radio Club will hold its 11th annual hamfest and flea market on June 19, 1982, from 8:30 am to 4:00 pm at Columbia Park, Dunellen NJ. There will be door prizes and a snack bar. Admission is $3.00 for sellers and $2.00 for lookers. Talk-in on 146.625/.025 (W2QW) and 146.52 direct. For further information, call Bob KB2EF at (201)-369-7038.

PAYETTE ID
JUN 19-20

The Voice of Idaho Amateur Radio Club and the Treasure Valley Radio Association will hold the fifth annual Treasure Valley Hamfest on June 19-20, 1982, from 9:00 am Saturday to 3:00 pm Sunday at the Mini-dome, Payette ID. Registration includes breakfast, dinner, and prize tickets, and is $15.00 in advance and $20.00 at the door. Features will include swap tables, dealers, transmitter hunts, special activities for ladies and children, games, contests, prizes, a cocktail party on Sunday, a picnic and banquet on Saturday, and a breakfast on Sunday. Talk-in on 147.84/.24 (WB7NSE/R), 147.72/.12 (K7OJI/R), and 146.52. For more information, contact Samuel K. Sower N7DOV, 1909 Grant Street, Caldwell ID 83605, or phone (208)-459-8132.

MOORHEAD MN
JUN 19-20

The ACE Radio Club will hold its first radio and computer flea market on June 19-20, 1982, beginning at 8:00 am at the Moorhead Centennial Arena, Moorhead MN. Talk-in on 146.970. For complete detailed information, send an SASE to ACE, PO Box 452, Moorhead MN 56560.

LANCASTER OH
JUN 20

The Lancaster and Fairfield County Amateur Radio Club will hold its annual Lancaster Hamfest on June 20, 1982, from 9:00 am to 5:00 pm at the Fairfield County Fairgrounds, Lancaster OH. Tickets are $2.00 in advance or $3.00 at the door. Flea-market tables will be available or bring your own. There will be hourly drawings, refreshments, and plenty of free parking. Talk-in on 147.03/.63 or 146.52. For additional information or advance tickets, write Box 3, Lancaster OH 43130.

CROWN POINT IN
JUN 20

The Lake County Amateur Radio Club will hold its 10th annual Dad's Day Hamfest on June 20, 1982, at the Industrial Arts Building at the Lake County Fairgrounds, Crown Point IN. Prizes will be featured and all events will be held indoors. Tickets are $2.50. Talk-in on 147.84/.24 or .52. For advance tickets, mail check to Lake County ARC, c/o Walley Kozol KA9FDC, 624 N. Rensselaer Street, Griffith IN 46319.

MILWAUKEE WI
JUL 8-11

The YL International Single Sidebander's (YLISSB) 1982 Convention will be held on July 8-11, 1982, in Milwaukee WI. Activities will include the DX Roundup, the Systems Awards Banquet on Saturday night, and a major door prize of an Icom IC-2AT. Jean Chittenden WA2BGE will tell about her recent China trip. Pre-convention activities will begin July 5, 1982, with golfing, fishing, and side trips planned. Detailed information may be obtained by sending an SASE (business size) to Sus Musachi KB9OC, PO Box 18123, Milwaukee WI 53218.

STATE COLLEGE PA
JUL 10

The Nittany Amateur Radio Club Ham Festival will be held on July 10, 1982, from 8:00 am to 4:00 pm, at the HRB-Singer picnic grounds, Science Park Road (between US 322 West and Rte. 26 East), State College PA. Talk-in on 146.16/.76, 146.25/.85, and 146.52. Features will include a flea market, technical sessions, numerous prizes and contests, and refreshments. Tickets are $3.00; tailgating and tables are $5.00. For more information, contact Richard L. Sine KB3WN 1600 E. Branch Road, State College PA 16801.

OAK CREEK WI
JULY 10

The South Milwaukee Amateur Radio Club will hold its annual swapfest on Saturday, July 10, 1982, from 7:00 am to 5:00 pm at the American Legion Post 434, 9327 South Shepard Avenue, Oak Creek WI. Admission is $2.00 and includes a happy hour with free beverages. Prizes include a $100 first prize and a $50 second prize plus a variety of other prizes to be awarded during the day. Parking, a picnic area, hot and cold sandwiches, liquid refreshments, and overnight camping will be available. Talk-in on 146.94. More details, including a map, may be obtained from the South Milwaukee Amateur Radio Club, PO Box 102, South Milwaukee WI 53172.

MILTON ONT CAN
JUL 10

The Burlington Amateur Radio Club will hold the 8th annual Ontario Hamfest on Saturday, July 10, 1982, at the Milton Fairgrounds, Milton, Ontario. Admission is $3.00 per person or $2.00 for pre-registration. There will be a flea market, displays, an auction, contests, and prizes. Camping will be available and grounds will open Friday night for early campers. For preregistration, contact Mike Cobb VE3MWR, PO Box 836, Burlington L7R 3Y7, Canada.

BOISSEVAIN MAN CAN
JUL 10-11

The 19th annual International Hamfest will be held on July 10-11, 1982, on the Canadian side of the International Peace Gardens between Dunseith ND and Boissevain MAN in the Canadian Pavilion. Activities will include transmitter hunts, mobile judging, CW and OLF contests, seminars for OMs and YLs, flea markets, a ham auction, a Saturday night dance, a Sunday morning breakfast, and lots of great prizes. For more information, contact Bernie Arcand WDØMD, PO Box 53, Epping ND 58843, or William M. Shryock, Jr. WDØGRC, 322 East 4th Street, Williston ND 58801.

RAPID CITY SD
JUL 10-11

The Black Hills ARC will hold the annual South Dakota Hamfest on July 10-11, 1982, at the Surbeck Center, SD School of Mines and Technology, Rapid City SD. Pre-registration is $7.00; registration at the door is $8.00. There will be a prize drawing for pre-registrants, forums, contests, a picnic, and prizes. Tables are free for the flea market. Talk-in on .34/.94 (WØBLK). For further information, write Black Hills ARC, c/o Rudy WBØPWA, 4822 Capitol, Rapid City SD 57701.

MAPLE RIDGE BC CAN
JUL 10-11

The Maple Ridge ARC will hold its Hamfest '82 on July 10-11, 1982, at the Maple Ridge Fairgrounds, located 30 miles east of Vancouver, Maple Ridge BC. Registration for hams is $5.00; for non-hams over 12 years old, $2.00. There will be food, prizes, a swap & shop, displays, a bunny hunt, ladies' and children's programs, and a main prize drawing for a Kenwood TR-2500. Camper spaces will be available (some with electrical hookups). Talk-in on 146.20/.80. For more information and registration, contact Maple Ridge ARC, Box 292, Maple Ridge BC V2X 7G2.

INDIANAPOLIS IN
JULY 11

The Indiana State Amateur Radio Convention, in conjunction with the Indianapolis Hamfest and Computer Show, will be held on Sunday, July 11, 1982, at the Marion County Fairgrounds at the southeastern intersection of I-74 and I-465. Gate tickets are $4.00 and entitle you to all activities, including the major prize drawing and hourly prizes. There will be inside and outside flea markets, a separate computer show and flea market, a commercial vendors' display area, technical forums, club activities, and ladies' programs. There will be setups after 12:00 noon on Saturday, July 10th. Security will be provided Saturday night and Sunday, and camper hookup facilities will be available on the grounds. For further information, contact Indianapolis Hamfest, Box 11086, Indianapolis IN 48201.

ALEXANDER NY
JUL 11

The Genesee Radio Amateurs, Inc., will hold the second annual ARRL-approved Batavia Hamfest on Sunday, July 11, 1982, from 7:00 am to 5:00 pm at Alexander Firemen's Grounds, Rte. 98 (nine miles south of Batavia), Alexander NY. Registration is $2.00 in advance, $3.00 at the gate, and $1.00 for the flea market. There will be many prizes, a large exhibit area, OM and YL programs, contests, plenty of food, overnight camping, and a boat anchor auction at 3:00 pm. Talk-in on 4.71/5.31 (W2RCX) or .52. For advance tickets, make

checks payable to Batavia Hamfest, c/o Gram, Inc., Box 572, Batavia NY 14020.

HARBOR SPRINGS MI
JUL 17

The Straits Area Amateur Radio Club will hold its annual hamfest on July 17, 1982, from 9:00 am to 4:00 pm at the Harbor Springs High School, Harbor Springs MI. Donations are $2.00 at the door and table space is $2.50. Doors will be open at 8:00 am for setups. Lunch will be served from 11:00 am to 1:00 pm and refreshments will be available during the day. There will be one main door prize and smaller prizes will be awarded hourly. The school parking lot is free for self-contained RVs to use for an overnight stay and many places of interest to YLs are available nearby. Talk-in on .52/.52 and 146.07/.67. For more details, contact Mr. Bernie Slotnick KB8RE, 630 Ann Street, Harbor Springs MI 49740, or call (616)-526-5614.

EUGENE OR
JUL 17-18

The Lane County Ham Fair will be held on July 17-18, 1982, at the Oregon National Guard Armory, 2515 Centennial, Eugene OR. Tickets are $4.00 each and entitle the holder to one extra drawing ticket free if purchased before July 1st. Doors will open at 8:00 am Saturday and Sunday. Features will include a swap and shop at $5.00 a table, a 2-meter bunny hunt, women's activities, a children's corner, computer demos, technical seminars, OCWA, and a grand prize of an Icom 730 low-band mobile rig. There will be an all-day snack bar, free parking for RVs (no hookups), and a Saturday potluck supper at 6:00 pm. Talk-in on .52/.52, 146.28/.88, 147.86/.26, and 3.910 HF. For advance tickets, send an SASE to Eunice Brown WA7MOK, 2456 Corral Court, Springfield OR 97477, or phone (503)-747-7939.

WASHINGTON MO
JUL 18

The Zero Beaters Amateur Radio Club will hold its hamfest on Sunday, July 18, 1982, at the Washington Fairgrounds, Washington MO. Talk-in on 147.84/.24. For more information, contact Rich Noelke WAØNUI, Rte. 3, 10 Richard Drive, Washington MO 63090.

BOWLING GREEN
JUL 18

The 17th annual Wood County Ham-A-Rama will be held on Sunday, July 18, 1982, at the Wood County Fairgrounds, Bowling Green OH. Gates will open at 10 am, with free admission and parking. There will be drawings for prizes: tickets are $1.50 in advance and $2.00 at the gate. Trunk sales space and food will be available. Advance table rentals are $3.00 to dealers only. Saturday setup available until 8:00 pm. K8TIH talk-in on .52. For more info or dealer rentals, send an SASE to Wood County ARC, c/o S. Irons, PO Box 73, Luckey OH 43443.

CANTON OH
JUL 18

The Tusco Radio Club (W8ZX) and the Canton Amateur Radio Club (W8AL) will hold the 8th annual Hall of Fame Hamfest on July 18, 1982, at the Nimishillen Grange, 6461 Easton Street, Louisville OH. Admission is $2.50 in advance, $3.00 at the gate, and children under 16 will be admitted free. The flea market will open at 9:00 am and activities will include awards, forums, dealers, and XYL programs. Talk-in on 146.19/.79, 146.52/.52, and 147.72/.12. For reservations and/or information, contact Butch Lebold WA8SHP, 10877 Hazelview Avenue, Alliance OH 44601, or phone (216)-821-8794.

GRAND RAPIDS MN
JUL 18

The Range Wide Hamfest will be held on July 18, 1982, from 10:00 am to 4:00 pm at Gunn Park, Highway 38, 6 miles north of Grand Rapids MN. Admission and tables are free. Bring the family for a picnic, games, prizes, and fun. Parking and campgrounds will be available. Talk-in on 146.28/.88 and .52. For more information, write Bob WDØAAF, 736 Crystal Springs Road, Grand Rapids MN 55744, or call (218)-326-2268 (evenings).

POUGHKEEPSIE NY
JUL 24

The Mt. Beacon Amateur Radio Club will hold its annual hamfest on July 24, 1982, beginning at 8:00 am, at the Arlington Senior High School, Poughkeepsie NY. Admission is $2.00 (XYLs and children admitted free), tailgating space is $3.00 (includes 1 free admission), and a table space is $4.00 (includes 1 free table and admission). There will be the free flea market tables indoors, parking door prizes, an auction starting at 2:00 pm, and hot food and beverages. Talk-in on 146.37/.97 and 146.52. For additional information, advance tickets, or registration, send an SASE to Walt Cotter WA2ZCN, North Hillside Lake Road, Wappingers Falls NY 12590, or phone (914)-226-6636.

WEST FRIENDSHIP MD
JUL 25

The Baltimore Radio Amateur Television Society (BRATS) will hold its annual BRATS Maryland Hamfest on Sunday, July 25, 1982, at the Howard County Fairgrounds, Route 144 at Route 32, adjacent to Interstate 70, about 15 miles west of Baltimore, in West Friendship MD. Indoor tables with ac power are $15.00 each; without ac power, $10.00 each. Indoor tailgating is $5.00 per space; outdoor tailgating is $3.00 per space. Overnight RV hookups will be available. For more information and reservations, write to BRATS, PO Box 5915, Baltimore MD 21208.

CENTREVILLE MI
JUL 25

The Amateur Radio Public Service Association of St. Joseph County MI will hold its 4th annual swap and shop on July 25, 1982, at the St. Joseph County Fairgrounds, Centreville MI. Doors open at 8:00 am. Tickets are $2.00 in advance and $3.00 at the gate. Indoor tables are $2.00. Trunk sales are free. Camping is available Saturday night only for $6.00. Talk-in on 146.52. For more information, contact Dennis Cutler N8DDU, 3051 Z Avenue, Vicksburg MI 49097.

WHEELING WV
JUL 25

The Triple States Radio Amateur Club will hold its 4th annual hamfest on Sunday, July 25, 1982, from 9:00 am to 4:00 pm, at Wheeling Park, Wheeling WV. Admission is $2.00 (50/50); children under 12 will be admitted free. There will be major prizes plus door prizes every 15 minutes; a 15-minute auction every hour on the hour; free parking for 1,000 cars; refreshments; ARRL/SWOT/TSRAC booths; indoor dealer displays; and a flea market. There will be setups the night before or at 7:00 am Sunday morning. Talk-in on 146.31/.91 and 146.52. For advance dealer registration, electrical outlet and table requests, submission of free ads for the club's hamfest issue, and more information, contact TSRAC, Box 240, RD 2, Adena OH 43901.

PITTSBURGH PA
AUG 1

The 45th annual South Hills Brass Pounders and Modulators Hamfest will be held on August 1, 1982, from 10:00 am to 4:00 pm, at South Campus, Community College of Allegheny County, Pittsburgh PA. Admission is $2.00 or 3 for $5.00. There will be computer, OSCAR, and ATV demonstrations, as well as a flea market. Talk-in on 146.13/.73 and 146.52. For further information, contact Andrew L. Pato WA3PBD, 1433 Schauffler Drive, West Homestead PA 15120.

ANGOLA IN
AUG 1

The Steuben County Radio Amateurs will hold the 24th annual FM Picnic and Hamfest on Sunday, August 1, 1982, at Crooked Lake, Angola IN. Admission is $2.50. There will be prizes, picnic-style BBQ chicken, inside tables for exhibitors and vendors, and overnight camping. (A fee will be charged by county park.) Talk-in on 146.52 and 147.81/.21.

SAUK RAPIDS MN
AUG 8

The St. Cloud Radio Club will hold its annual hamfest on Sunday, August 8, 1982, from 8:30 am to 4:00 pm, at the Sauk Rapids Municipal Park, Sauk Rapids MN. Talk-in on 146.34/.94. For more information, contact Mike Lynch, 2115-1st Street, St. Cloud MN 56301, or call (612)-251-2297.

TACOMA WA
AUG 14-15

The Radio Club of Tacoma will hold Hamfair 82 on August 14-15, 1982, at the Pacific Lutheran University campus, Tacoma WA. Registration is $5.00 and dinner is $7.50. Activities will include technical seminars, a flea market, commercial booths, an ARRL meeting, a repeater forum, a VHF tweak and tune clinic, prizes, raffles, and a loggers' breakfast. Talk-in on 147.88/.28. For more information, contact Grace Teitzel AD7S, 701 So. 120th, Tacoma WA 98444, or phone (206)-564-8347.

TIOGA COUNTY PA
AUG 21

The Tioga County PA ARC 6th Annual Amateur Radio Hamfest will be held on Saturday, August 21, 1982, from 0800 to 1600 at a new location at Island Park, just off US Rte. 15, Blossburg PA. There will be a flea market, food, free camping, an auction, an H/T door prize, etc. Talk-in on .19/.79 and .52. For more information or advance tickets, write Tioga Co. ARC, PO Box 56, Mansfield PA 16933, or contact Paul Sando KC2AZ, 606 Reynolds Street, Elmira NY 14904 on .19/.79 or .96/.36.

MARYSVILLE OH
AUG 21-22

The Union County Amateur Radio Club will hold the Marysville Hamfest on Saturday afternoon and all day Sunday, August 21-22, 1982, at the fairground in Marysville (near Columbus) OH. Admission is $2.00 in advance or $3.00 at the gate. Flea market space is $1.00. Food, beverages, and free overnight camping, movies, and popcorn will be available. Featured on Saturday night will be a free square dance (with a live band) followed by a big country breakfast available all night. Door prizes, ladies' programs, and ARRL, FCC, and MARS meetings will be featured on Sunday. Talk-in on 146.52 and 147.99/.39. For additional information, write UCARC, 13613 US 36, Marysville OH 43040, or call (513)-644-0468.

AUGUSTA ME
SEP 10-12

The Augusta Emergency Amateur Radio Unit will hold the ARRL-approved Northeast Area Hamfest on September 10-12, 1982, at Windsor Fairgrounds, located just off Route 17, 10 miles east of Augusta ME. Facilities for campers will be available. Activities will include a flea market and regularly scheduled speakers and demonstrations, as well as the usual events. Talk-in on 146.22/.82 and 3940.

ADRIAN MI
SEP 26

The Adrian Amateur Radio Club will hold its 10th annual hamfest on Sunday, September 26, 1982, at the Lenawee County Fairgrounds, Adrian MI. Talk-in on 146.31/.91 (W8TQE). For tickets, tables, and more information, contact the Adrian Amateur Radio Club, Inc., PO Box 26, Adrian MI 49221.

NEW LONDON NH
SEP 26

The 6th annual Connecticut Valley FM Association Hamfest/Flea Market will be held on Sunday, September 26, 1982, from 9:00 am to 5:00 pm, at King Ridge Ski Area, New London NH. Adult admissions are $2.00, a flea-market setup is $5.00, and children under 16 will be admitted free. King Ridge will have the food concession. For more information, contact Francis Callahan KA1BWE, Box 173, East Wallingford VT 05742.

CHICAGO IL
OCT 17

The Chicago Citizens Radio League will hold its first annual hamfest on October 17, 1982, at the North Shore American Legion Post, 6040 N. Clark, Chicago IL from 7:00 am to 4:00 pm. Due to limited table space, table reservations must be made in writing to Fred Marlette KA9FUO 1851 W. Chase, Chicago IL 60626.

HAM HELP

I would appreciate hearing from anyone who has made *any* modification to the Kenwood TR-7500 2-meter FM transceiver.

R. L. Rabenstein WB3JJG
2904 W. Pine Avenue
Altoona PA 16601

I am looking for information regarding the serial numbers on Vibroplex units and the year of their manufacture.

Richard Randall K6ARE
1263 Lakehurst Rd.
Livermore CA 94550

HAM HELP

A while back, Poly Paks was selling a surplus keyboard, minus the keytops, made by C. P. Clare and Co. for Burroughs Corp. If anyone has one of these boards or extra keyswitches, I would like to buy them.

Ralph Alexander WB5ORH
Box 236
Lefors TX 79054

I recently purchased a Hammarlund Model SP-600 and a Hammarlund HC-10 converter (less hookup adapter). I will pay for manuals or any information, copies, postage, etc., regarding these two units and their compatibility. I am also in need of an adapter for the HC-10.

C.L. Gantz, Jr.
515 E. Fulton St.
Lancaster PA 17602
(717)-393-1262

I am in need of a tube-specification manual which covers receiving and transmitting types.

Larry Schad
Box 332
Afton IA 50830

I am in need of some donated QSL cards.

Gary Mitchell KH8AC
PO Drawer 909
Pago Pago, American Samoa
96799

I am in need of schematics and parts lists for the power supply and tape reader of an NCR Model 400-500 Teletype® (power supply schematic no. 095-0009500 and tape reader Model GE 4APTR61G002, serial no. 5628). Have copier or please advise.

Also needed is a dial plate (or copy) for the Philco AM/SW Model 41-250 radio, Code 121.

H. W. Wallmeier
700 W. 7
Washington MO 63090

Does anyone have information on the whereabouts of VP6LX (April, 1963) or W2PCJ/KJ6 (August, 1963)?

George Oster K0EDA
524 6th St.
West Des Moines IA 50265

I need a schematic and manual for a Gonset G151 FM Communicator.

Mark Rethemeyer
1531 Belmont
Kansas City MO 64126

I need a schematic, and service and upgrade information for the Sommerkamp FTdx-150 transceiver.

Charles Wendler K2BOZ
58 South Airmont Rd.
Suffern NY 10901

I would like to correspond with hams who have operated with or are operating with a Hallicrafters FPM300. I am interested in troubleshooting an existing problem and in learning about any modifications which can be done on this rig.

Neil F. Haeger WD6CVA
14402 Cartels Dr.
La Mirada CA 90638

I am looking for a model DD-1C Spectronics frequency readout for my Collins 75S-3 receiver.

R. E. Foltz W7JQO
PO Box 2126
Sedona AZ 86336

I need the service manual for the Clegg "99'er" 6-meter transceiver along with any information on home-brewing a suitable vfo and FMing the unit. I will pay for postage and copying.

Kevin Van Zuilen KA9GWB
205 Lehman St.
Berne IN 46711

I am looking for a schematic for an SBE VHF power amplifier, model SB-1PA.

Lennox Bodman K1NBG
29 Mt. Vernon St.
Gardiner ME 04345

I need a service manual and schematic for a Phillips Telecommunications receiver type BX 925A/09 NR BC 8380/SO502.

Mark A. D'Ornellas 8R1Y
110 Barrack St.
Kingston, Georgetown
Guyana

I need schematics, technical manuals, and crystal information for an AN/VRC-52 radio set (T-891/VRC-52 and R-1146/VRC-52). I will pay any reasonable charges for copying and postage, or will copy and return.

John Wilson KC1P
15 Kennedy Rd.
Cambridge MA 02138

I would like to hear from hams who use the Exidy Sorcerer for ham applications of any nature.

John Stover N9AMC
1521 Medora St.
South Band IN 46628

I would like to convert a model 1-636 Royce SSB/AM 23-channel CB radio for use on the 10-meter band. Any information on how to do this would be helpful.

Lyle G. Plum WB7PXQ
3807 East Emile Zola
Phoenix AZ 85032

I need a schematic and manual for a Hammarlund HQ 100 receiver. All costs will be gladly paid.

Patrick J. Chivington W8JIB
1478 Grace Ave.
Lakewood OH 44107

I need a schematic and any technical advice for keyboard assembly 055-13-02-7OREV by Incoterm Corp., particularly for RTTY. All reasonable expenses refunded.

W. G. Mott G4KLP
2 London Bridge
London, SE1 9RB
England

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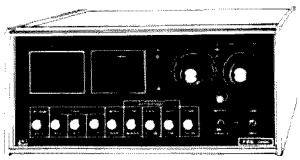

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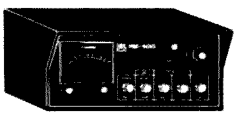

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HAM HELP

I am looking for active Radio Shack TRS-80 and Sinclair ZX-81 computer user's nets. I am interested in when these nets meet and the frequencies they meet on. I am also interested in the locations of the following aircraft and marine beacons (all frequencies in kHz): A-320, BNO-396, BNU-396, COR-206, EBY-391, FR-355, GWF-282, HMM-410, INE-521, LYI-415, MF-371, NO-351, OT-376, PNA-392, QQ-401, RD-410, SL-288, TA-390, UNB-388, VI-220, XSD-278, and ZP-368.

Gary Payne KE6CZ
1347 E. Dakota
Fresno CA 93704

I need a manual for the Beckman-Berkley model 7751 frequency counter and a 1000-kHz, 115-V ac crystal oven for same. I am also looking for the manual for the 312B4 Collins speaker console. I will purchase outright or copy and return.

Bill Neilsen WB4APC
Rt. 2, Box 253E
Radcliff KY 40160

I would like to obtain a motor-divider PC board number 1A2 for a GXC5 military FAX unit. A schematic and/or manual for this would be handy.

Al Cikas KA9GDL
2112 Stonehenge
Springfield IL 62702

I need schematics or any information for the Hammarlund HQ110, Hammarlund HQ180, and Hammarlund HX500 transmitter. I also need information on the Teletype® 28RO teletype machine and the Gonset G-50 6-meter Communicator, and instructions on how to convert the Communicator to FM.

Tom Blessing
294 Helen Ave.
Xenia OH 45385
(513)-372-9341

I would like to use my TRS-80 Model I for SSTV work and would like to get in contact with anyone who has information on how to do this.

Dale Clark N9APX
40194 N. Glendale
Zion IL 60099

I am looking for:

- the instruction booklet for using the Johnson transceiver tester
- information on how to convert the Heathkit SB310 receiver for 10- and 15-meter band coverage
- *information on how* to modify the Heathkit SB102 for more sophisticated operation

I will copy and return or forward payment for the above.

Robert Ross VE3LPJ
4 Meadowlane Dr.
Brampton, ONT L6W 2R4
Canada

Is there a reader of *73* who can write an article about the Japanese radio-intercept training program that took place at the Eastern Signal Corps Training Center in Ft. Monmouth NJ in 1944?

Gordon E. Hopper
75 Kendall Ave.
Framingham MA 01701

I am interested in the 1750-meter band and would enjoy hearing from someone who is/was using this frequency. I am interested in learning about receiver conversion and transmitter design, as well as activity on this band.

Rex Faulkner N4EYE
3413 Covington Dr.
Augusta GA 30909

An amateur in the Ivory Coast is looking for a RTTY program and interface to use with the Atari 800 computer. Can anyone help me to help him?

Fred Trick, Sr. KB9UB
Zetfred Company
PO Box 265
North Manchester IN 46962

Wanted: Robot Model 70 SSTV monitor, regardless of condition.

Dante Ventriere KA4JRE
17831 NW 81 Ave.
Hialeah FL 33015

Wanted: amateur radio QSL cards prior to 1930 for old-time display.

Dave Noon VE3IAE
19 Honeysuckle Cr.
London, Ontario
Canada N5Y 4P3

I am looking for a schematic, service manual, and connections for a Motorola Twin V Trans-type CC 3006 6/12-volt radiophone, model W43GGD-2. I am also looking for information on the BC733F radio receiver. I will pay all costs for postage and handling.

William Pence
800 Old Stage Rd.
Cave Junction OR 97523

I need a schematic or any *other information on* the model 300/600 digital counter sold by Crescent Wire and Cable Company, circa 1976.

Harold May
428 Phillippa
Hinsdale IL 60521

I need a schematic and operating manual for a Knight KG-2100 dc oscilloscope.

Joe Bische KA4HAG
3412 29th St. W.
Bradenton FL 33505

Our club is in dire need of a service manual for a Johnson Thunderbolt linear amplifier, catalog # 240-353.

Ronald Daly WB9ZNI
Hot Springs
Amateur Radio Club
Box 385
Hot Springs SD 57747

I need schematics for the 2-meter Edgecomm mobile radios 25A and 3000A. I will pay copy costs and postage.

Rudolph Fallang KA7DTA
717B SE 6th
College Place WA 99324

I am looking for a DG-5 digital display and a DS-1A dc-dc converter for a Kenwood TS-520S. Please state condition and price, including shipping.

John P. Iorio WD4MWH
5228 Longview Dr.
New Port Richey FL 33552

I am looking for a Vocaline AT-30 420-MHz transceiver. These units are very old, but I am sure that one can be found.

Allen Harris
3047 Worden St.
Muskegon MI 49441

I am in need of a source for stainless spring rod in pieces that are five feet long and no more than 1/8" in diameter. Tapered replacement CB whips are not quite long enough.

Stan Hockman KA4DSK
638 Flager Blvd.
Lake Park FL 33403

I need a schematic diagram for a Collins 651S general-coverage receiver. I will pay for the copies and postage.

Tom Kormanik
14114 St. Marys Ln.
Houston TX 77079

I am looking for a Hallicrafters SX-73 or SX-73A receiver. I would like to use the receiver for DXing the 540-1600-kHz broadcast band.

John Creque
1121 Berdan Ave.
Toledo OH 43612

I am looking for a schematic and service manual for the model 33 Sideband Engineers transceiver. I would also like some information on how to convert this rig for CW use.

Ka Kanana
158 SW Oaklyn St.
Palm Bay FL 32905

I am returning home from Germany to the Rome/Cartersville, Georgia, area. Any job information for a First Class Radiotelephone and amateur Extra class licensee commencing in August would be most appreciated.

B. G. Echols, Jr.
WA2NYR/DA2EJ
University of Maryland
Jaeger Kas., Bldg. 26
APO New York NY 09162

I would like to get a Novice license. Are there any nearby hams that could help me on my days off? An hour every other weekend would be a great help.

Robert Good
Box 86
Overbrook KS 66524
(913)-665-7483

I need a service manual and schematic diagram for a Motorola T41GGV series "Twin V" transceiver. I will pay reasonable copying costs or copy and return.

Jeffrey Miller WD4SMA
2112 Natahoa Court
Falls Church VA 22043

I am looking for manuals and specification sheets for Hallicrafters SX101 and SX42 receivers. I will buy your originals or pay for copying.

Bob Allie
736 Pine St.
Central Falls RI 02863

CORRECTIONS

The TVRO filter/amplifier and demodulator circuit boards shown in "'Lite Receiver IV," May, 1982, are double-sided. The foil patterns for the component (top) sides of these boards are given here as Figs. 2 and 3.

J. Richard Christian WA4CVP
Mobile AL

Please note the following information:

- The coaxial collinear described in "Omni-Gain," an article in the May issue of *73*, is incorrectly shown in Fig. 3. The ¼-wave stub should be shorted at both ends, as described in the text.
- A complete kit of parts for the "Fun-Amp" featured in the May, 1982, issue is available from Radiokit, Box 4115, Greenville NH 03048 for $37.95.

Tim Daniel N8RK
***73 Magazine* Staff**

The printed circuit board layout for "Home-Brew a TVRO Downconverter," March, 1982, should have included both sides. The top and bottom of the board should be etched as shown here in Figs. 4 and 5.

Also, the three coupling capacitors shown in the parts placement diagram should be 50-pF disc ceramics, not the .01-uF ones shown.

S. F. Mitchell WA4OSR
Mobile AL

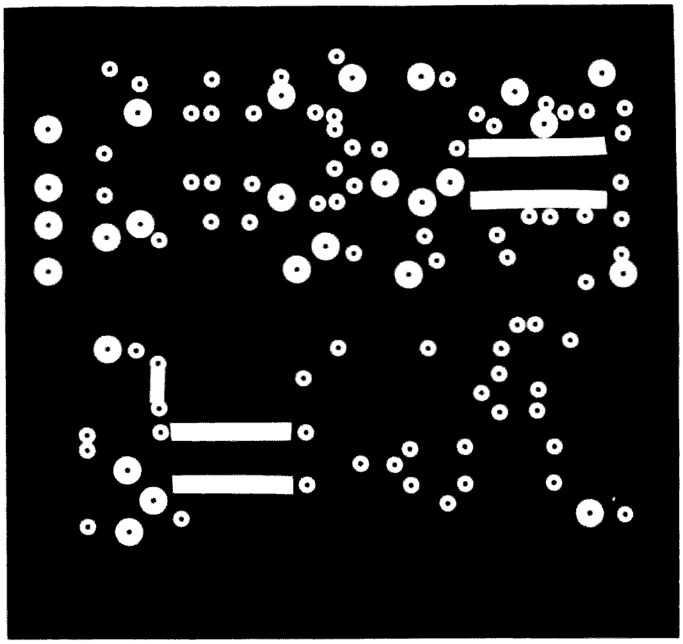


Fig. 3. Foil layout for top side of the demodulator board.

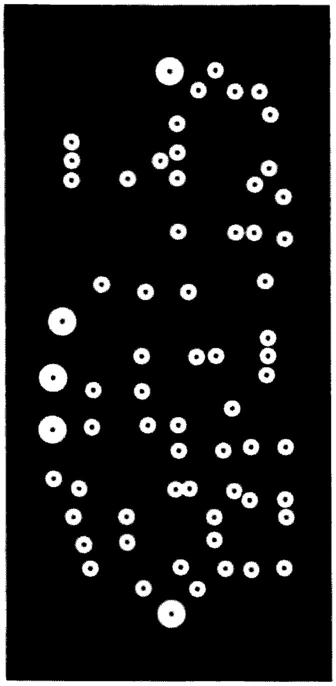


Fig. 2. Foil layout for top side of the filter/amplifier board.

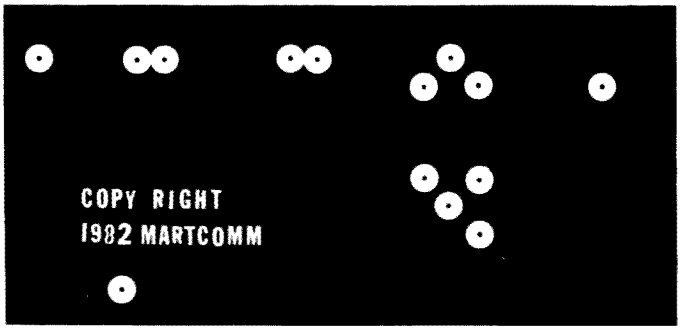


Fig. 4. Top side of double-sided circuit board.

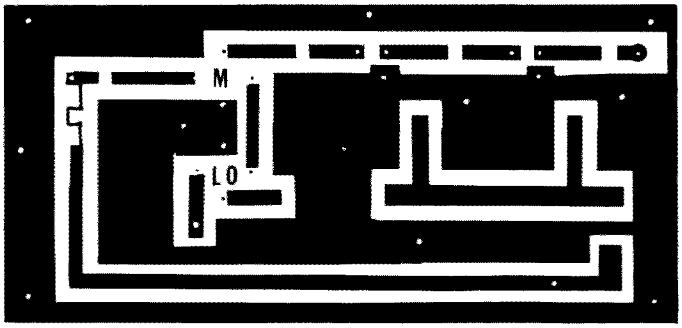


Fig. 5. Bottom side of downconverter circuit board.

SATELLITES

BEYOND PHASE IIIB

With the Phase IIIB launch still set for early July, there are now increasingly bright prospects for geosynchronous launch opportunities for amateur satellites. It appears that there may be two such possibilities by the end of 1985. The first of these is a test flight of a vehicle designed for launching a new US defense satellite. The second is a test launch of a new European Space Agency (ESA) vehicle called Ariane 4.

In both cases, the available payload is enormous by amateur satellite standards: 1200 pounds for the US launch and 4400 pounds for the ESA flight. Needless to say, AMSAT officials on both sides of the Atlantic are pursuing these unique opportunities. It has been suggested that the time may be at hand for AMSAT to coordinate its activities with other amateur space groups, in order to make full use of the large payloads. It may well be a case of "use it or lose it."

SPACEWEEK: JULY 16-24

The week of July 16-24 marks the 13th anniversary of the Apollo 11 flight, during which man first set foot upon the moon. "Spaceweek" is a national celebration to commemorate this historic event and to demonstrate public support for space exploration. Activities include exhibits, lectures, and a petition drive to show our leaders in Washington DC that Americans really do favor an active role in space for the United States.

Spaceweek activities in each local area are organized by volunteer groups. The *Spaceweek Handbook*, which tells how to conduct a local Spaceweek, is available from the group's headquarters for a $10 donation. Write to Spaceweek National Headquarters, PO Box 58172, Houston TX 77258.

The above informaton is courtesy of *AMSAT Satellite Report*, PO Box 27, Washington DC 20044.

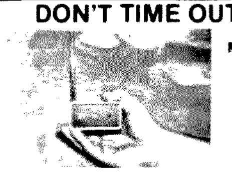
OSCAR 8 Orbital Information for June

Orbit #	Date	Time (GMT)	Eq. Crossing (Degrees West)
21603	1	0102:51	81.9
21617	2	0107:22	83.0
21631	3	0111:53	84.2
21645	4	0116:24	85.4
21659	5	0120:55	86.5
21673	6	0125:26	87.7
21687	7	0129:57	88.8
21701	8	0134:28	90.0
21715	9	0138:59	91.2
21728	10	0000:19	66.5
21742	11	0004:50	67.7
21756	12	0009:21	68.8
21770	13	0013:52	70.0
21784	14	0018:23	71.2
21798	15	0022:55	72.3
21812	16	0027:26	73.5
21826	17	0031:57	74.6
21840	18	0036:28	75.8
21854	19	0040:59	77.0
21868	20	0045:30	78.1
21882	21	0050:01	79.3
21896	22	0054:32	80.4
21910	23	0059:03	81.6
21924	24	0103:34	82.8
21938	25	0108:05	83.9
21952	26	0112:36	85.1
21966	27	0117:07	86.2
21980	28	0121:38	87.4
21994	29	0126:09	88.6
22008	30	0130:40	89.7

OSCAR 8 Orbital Information for July

Orbit #	Date	Time (GMT)	Eq. Crossing (Degrees West)
22022	1	0135:11	90.9
22036	2	0139:42	92.0
22049	3	0001:03	67.4
22063	4	0005:34	68.6
22077	5	0010:05	69.7
22091	6	0014:36	70.9
22105	7	0019:07	72.0
22119	8	0023:38	73.2
22133	9	0028:09	74.4
22147	10	0032:40	75.5
22161	11	0037:11	76.7
22175	12	0041:42	77.8
22189	13	0046:13	79.0
22203	14	0050:44	80.2
22217	15	0055:15	81.3
22231	16	0059:46	82.5
22245	17	0104:17	83.6
22259	18	0108:48	84.8
22273	19	0113:19	86.0
22287	20	0117:50	87.1
22301	21	0122:21	88.3
22315	22	0126:52	89.4
22329	23	0131:24	90.6
22343	24	0135:55	91.8
22357	25	0140:26	92.9
22370	26	0001:46	68.3
22384	27	0006:17	69.5
22398	28	0010:48	70.6
22412	29	0015:19	71.8
22426	30	0019:50	72.9
22440	31	0024:21	74.1

DON'T TIME OUT . . . 'TIME IN'



Model TI-10 time alert for repeater operators to avoid timing out the repeater

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Can be used as I.D. reminder

Sensitive enough for handhelds
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Handsome styling, durable case
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Model TI-10 assembled $69
Model TI-10K, kit form $57
Printed Circuit Board and Documentation $20
Shipping and handling . . . . add $3

When ordering, please specify model. If you act before July 4, 1982 receive a $10 discount on the TI-10; $5 discount on the TI-10K

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FUN!

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LOGIC PUZZLES

Recently, on a day when 15 meters was dead and I had nothing else to do, I pulled out my Dover Books catalogue and began thumbing through its pages. For those of you not acquainted with this firm, Dover is a company specializing in all types of quality paperback reprints priced from about one to five bucks. Within the pages of their catalogue, you can find books on subjects ranging from dying cloth with crushed insects, to the complete engravings of Albrecht Dürer. They also have a selection of old-fashioned postcards that can be made into fantastic QSLs.

At any rate, I'm plowing my way through this catalog and what should I see listed but a book by Hiram Percy Maxim. Yes, *the* Hiram Percy Maxim. As I mentioned in a column back in 1980, among HPM's many accomplishments was an autobiography entitled *A Genius in the Family* (later made into the 1946 movie *So Goes My Love,* starring Don Ameche and Myrna Loy). Well, it seems that Dover has dusted off this mighty tome and is offering it to an anxious public for the tantalizing sum of $1.50.

If you're interested in ordering a copy (and should any *real* ham be without one?), you'll find it on page 52 of the 1981-82 catalogue listed between *The Handbook of Pictoral Symbols* and *Obedience Training For Your Dog.* To order, write to Dover Publications, 180 Varick Street (slightly south of the FCC), New York NY 10014, and ask for book 20948-2. Be sure to add 70¢ for handling. I can hardly wait to see the faces on the people at Dover when they suddenly get a few hundred requests for a book by Hiram Percy Maxim.

Last January's logic puzzle in the Reader's Corner seems to have struck a responsive chord. In fact, since the puzzle appeared, I've received over two dozen letters asking for more problems devoted to logic and reasoning. Since FUN! always aims to please its readers, this month we're dedicating the entire column to logic games. These puzzles are by far some of the most complex riddles ever published in FUN!, so be sure to keep a glass of ice water or some other suitable refreshment nearby. We don't want to burn out any brains.

ELEMENT 1—THE REPEATER COUNCIL

The Northern South Dakota Repeater Council has a highly involved system of repeater group representation. According to the rules of the council, each repeater is represented by four members, but because of overlapping repeater club memberships the following complications exist:

- Each person on the council is simultaneously the representative of two different repeater groups.
- Every pair of repeater clubs has one representative in common.

In this maze of conflicting allegiances, the NSDRC accomplishes little in the way of frequency coordination, which isn't unusual for a group of this sort. Nevertheless, the council's organization presents an interesting puzzle, which is: *How many repeater clubs are represented on the NSDRC and what are the total number of representatives?*

ELEMENT 2—THE JAMMER

A recent murder case involved the homicide of an alleged repeater jammer. In one order or another, six hams, Walt, Jimmy, John, Bob, Nat, and Harvey, were the victim, the murderer, the witness, the policeman, the judge, and the hangman. Here are the facts of the case: The victim had died instantly from the effect of a close-range gunshot wound. The witness did not see the crime committed, but testified to hearing an altercation followed by a shot. After a lengthy trial, the murderer was convicted, sentenced to death, and hanged.

- Nat knew both the victim and the murderer.
- In court, the judge asked Walt to give his account of the shooting.
- Harvey was the last of the six to see Jimmy alive.
- The policeman testified that he picked up John near the place where the body was found.
- Bob and Harvey never met.

What role did each ham play in this tragic story?

ELEMENT 3—DXCC COUPLES

Many husbands and wives are avid DXers. One afternoon, Stan, Frank, and Joe, along with their wives, whose names in random order are: Susan, Wilma, and Diane, got together to compare their DXCC totals.

- Diane, Wilma, Susan, and Frank have 206, 202, 200, and 194 countries respectively.
- Stan and Joe have 198 and 196 countries, but for some time they couldn't tell who had made which since they both had bad memories and lost their copy of *QST.*
- When the fellows finally found the *QST,* it turned out that two of the couples had the same total.
- Frank's wife has more countries than Stan's wife.

What is the name of each man's wife, and how many countries do Stan and Joe have confirmed?

ELEMENT 4—CENSORED MULTIPLICATION

The following example of multiplication has been attacked by the "Math Censor." He's taken most of the digits in this problem and replaced them with x's. It's up to you to restore the problem to its correct form. (Note: The 4s, 5s, and 6s remaining are not necessarily the only digits of those values in the example.)

```
      6 x x
      x x x
      -----
      x x x
    x x x x
  x 5 x 5
  ---------
  x x 5 x 4 x
```

Uncensor those digits!

ELEMENT 5—THE ORGANIZATION

Six hams: John, Mary, Carl, Stan, Harry, and Dick, are the only people interested in running for the offices of president, first vice president, and general manager of a certain national organization.

- John won't be an officer unless Harry is president.
- Mary won't serve if she outranks Carl.
- Mary won't serve with Dick under any conditions.
- Carl won't serve with both Harry and Dick.
- Carl won't serve if Dick is president or Mary is general manager.
- Stan won't serve with Carl or Harry unless he outranks them.
- Harry won't be first vice president.
- Harry won't be general manager if Stan is an officer.
- Harry won't serve with John unless Dick serves too.
- Dick won't serve unless either he or Carl is president.

How can the three offices be filled?

THE ANSWERS

Element 1:
There are ten persons representing five repeater groups.
Element 2:
Walt was the policeman, Jimmy the murderer, John the witness, Bob the victim, Nat the judge, and Harvey the hangman.

Element 3:
Stan is married to Diane, Frank is married to Wilma, and Joe is wed to Susan. Stan has 198 countries and Joe 196.

Element 4:

```
      645
      721
      ---
      645
    1290
   4515
   ------
   465045
```

Element 5:
Carl is the president, Mary the first vice president, and Harry the general manager.

SCORING

Element 1:
Twenty points.

Element 2:
Twenty points.

Element 3:
Twenty points.

Element 4:
Twenty points.

Element 5:
Twenty points.

Let's get logical.

1-20 points—Scatterbrain.
21-40 points—Utterly confused.
41-60 points—Room temperature IQ.
61-80 points—Computer-like.
81-100 points—Mr. Spock.

The following amateurs were missing from last month's list of those solving January's Reader's Corner. *Found 1 solution:* Ed Larose KS5V, John Hufschmid KI9J, Bob Kendall VE4ZH, and Marien Kendall XYL-VE4ZH.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

COMBATTING THE SUMMER DOLDRUMS

Doldrums. A state of inactivity, stagnation, or slump; a spell of listlessness. What the bands do in the summer. The pits. What do the enthusiasts of the various bands do during the summer doldrums?

The high level of atmospheric noise (QRN) ruins the lower frequencies for most DX. The 160-meter specialist disconnects the rig and spends the summer nights sleeping, dreaming of living on a mountain of copper plate. His days are filled designing the perfect ground and wondering if his neighbors will notice those copper wires in their swimming pools.

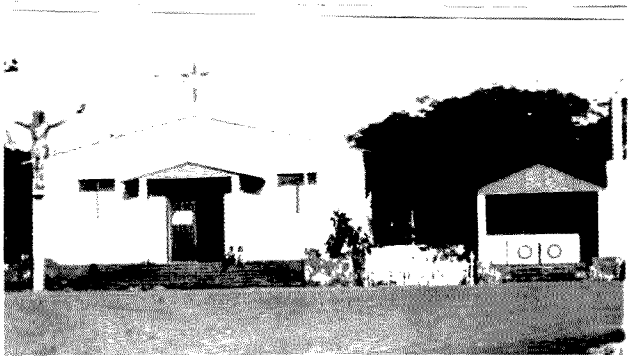
The 80-meter enthusiast splits his time between repairing winter-damaged wire antennas and checking the noisy sunrise and sunset openings for some other masochistic DXer. The pickings on the band are poor. There are too many leaves on the trees to shoot the arrow through the branches and haul the antenna up anyway. Maybe there's a baseball game on the tube.

The 40-meter DXer paces off his imaginary 2-element monobander in the back yard for the fifteenth time. No matter where he places the tower, the elements will hang over his neighbor's yard. That neighbor, of course . . . is the one who has never been very friendly since that incident with the TV set. It looks like another season with the inverted vee. Maybe a reflector element hung between that light post and the fence . . .

Twenty meters stays open, after a fashion, all summer. The high absorption and occasionally high noise level combine with amateurs pushed down from the higher bands so conditions are hectic. But it is possible to make contacts outside your continent. Antenna work can wait until the winter proves that the beam really is too big and blows it over.

Fifteen meters flashes with occasional excitement; it's probably the best band to watch carefully during the month. The

Father Dave Reddy, O.F.M., CE0AE. The Chilean flag has flown over Father Dave for years.



The Catholic church overlooking Main Street, Easter Island. Antennas mark CE0AE.

CE0AE as most of the amateur population sees (hears?) him. Father Dave's 5BWAS sits above the list of countries needed, the latter always at hand.

band opens toward the sun in the morning, often very rapidly. The most distant stations fade rapidly as the MUF climbs, but the shorter path DX stays strong for hours. The sunrise and sunset hours at the DX location remain the best bets.

Ten meters suffers badly from the summer doldrums. But the changeable ionosphere does give the band a little pizzazz once in a while. 15 meters provides a good predictor of 10-meter band openings. As 15 meters shortens up (the more distant stations lose signal strength, the closer stations improve), 10 might be opening in that direction. A rapid shortening of 15 suggests tuning to 10 and trying a few CQs. The first few stations on the newly opening band get the best DX.

Six-meter fans are finding F2 propagation scarce, but the always-exciting E-skip keeps the summer interesting. Solar flares liven the band a couple of times during the summer, but the real excitement awaits the return of shorter days.

DX activity and the overall level of effectiveness of the bands do indeed drop during the middle of the summer. The increase in solar radiation during the longer days increases the absorptive properties of the ionosphere much more than the refractive ones. The signals aren't escaping into space as they do when the maximum usable frequency is low. Our radio waves are being absorbed by the same ionosphere which permits long-distance communications in the first place.

But a few bright spots shine through the murky bands. The declining sunspot cycle flashes with a fickleness which strikes terror in many a propagation forecaster. A sudden solar flare can produce the most incredible long-path openings one night, and drive the absorption so high the next day that you can't work across the block. But favorable conditions as the flare just starts make up for the crummy conditions the next day or two.

Take advantage of these transient gifts to the dedicated DXer by checking the bands at least twice a day. Monitor WWV on a couple of different frequencies, if possible, until you can tell when conditions are a little strange, a little wilder than normal. Try some of those long-path directions and times. Most superb band conditions pass unexploited because "everyone knows the band isn't open *then*!"

Another encouraging aspect of the summer doldrums is the occasional cool breeze of good conditions. The level of absorption varies daily and frequently drops low enough to permit some good DXing. Again, daily or twice daily monitoring and occasional transmitting ensure catching these openings.

But during these months of perfect weather, between the occasional flashes of real excitement on the bands, this writer's attention begins to wander. I start to think how some of the South American amateurs are contending with the winter storms, amateurs such as our *73* profile: CE0AE.

When a visitor walks slowly up the wide, dusty main street, he looks toward the church square, drawing attention from the crumbling walls and rust-stained roof of the church itself.

But what is that sticking up above the roof of the church? It looks like. . . it is! A multiband vertical, with radials strung out just over the roof line. An RG-58 feedline runs off the back of the church and crosses over a long-neglected garden to a tiny house, overrun with vines and cats. A garden gate hangs from a strap of rubber tire under a collapsing grape arbor. The person who lives here has interests other than gardening.

Indeed, a telltale crackle from the window on your right hints at the avocation of the long-time resident: That smooth CW radiates from the fist of Father Dave CE0AE, on Easter Island, in the Pacific.

Father Dave Reddy, O.F.M., landed on this remote rock, thousands of miles from any other inhabited land, on the recommendation of Father Sebastian, the former Catholic priest of Easter Island. Father Sebastian, widely recognized as the father of modern archeology on Easter Island, as well as father of his flock, interviewed Father Dave in the United States shortly before the former's death. Soon thereafter, Father Dave embarked on the fulfillment of a longtime dream: operating ham radio from the South Pacific. He left the seminary in Buffalo, New York, where he had been teaching, for Santiago, Chile, to learn Spanish.

His arrival in Chile (the country which controls Easter Island) was untimely. Leftist leader Alliende rode to power on the back of anti-American slogans, and Father Dave could not get the necessary permission to assume his role as the spiritual leader of Easter Island.

Although the journey was neither short nor straight, Father Dave did finally arrive on Easter Island, with built-in status as one of the leaders of the tiny island. His predecessors in the role of Pastor of Isla de Pasqua helped forge a nucleus of "Who's Who" on Easter Island along with the Governor, Mayor, and heads of the small military units on the island. Father Dave rapidly forged another reputation as an active and congenial amateur radio operator, CE0AE.

Today, Father Dave welcomes visitors with the same friendly cheer so well known to his on-the-air contacts. His hearty laugh and ever-present smile and good humor provide a welcome touch of the States in this remote corner of the world. His Long Island twang, which strongly colors his Spanish, betrays his New York heritage. The visitor suspects he welcomes the chance to speak English other than "59 100."

It is hard to say which of the items I brought from the United States Father Dave most appreciated: the spark plugs and replacement gearshift knob for his jeep, the diodes to repair a seldom-used Collins 30L1 amplifier, or the two big jars of chunky peanut butter. I suspect the last. The food on Easter Island is monotonous and expensive, and the passing of the plate at the Sunday service permits few luxuries.

The presence of amateur radio visitors promised another bright spot in the slow life on Easter Island. Father Dave welcomed the assistance of the visiting amateurs in improving his antenna farm, heavily damaged by the storms which sweep in from the northwest. Spare parts and tower-climbing ability are scarce in Easter Island, but the generosity of his amateur visitors and a little help from some passersby left CE0AE with a credible set of skyhooks.

Father Dave divides his time on the Isla de Pasqua between his church, DXing, and his Boy Scout troop, one of two on Easter Island. On Chile's Constitution Day, he organized the Scouts into the parade, then raced to join the other island authorities in the viewing stand. The Scouts themselves quickly joined the viewers at the side of the parade route as soon as they passed the viewing stand. There simply aren't enough people on the entire island to both have a parade and have people watching it. Everyone serves double duty.

A good time to work CE0AE is during a contest. He lets few pass without at least a few contacts. He claims a *laissez faire* attitude toward amateur radio contests, but his actions suggest a more positive attitude toward their periodic madness. When his 10-meter signal appeared to be interfering with the public address system in his neighboring church, Father Dave would hear none of any suggestion that the visiting amateur curtail operations during

the Sunday service. "Nonsense! You go right ahead and operate. I'll turn off the church mike and talk louder." And he did!

While Father Dave often can be found in contests, he admits he prefers DXing to contesting. Easter Island lies south of the tropics, and the band conditions are not as uniformly superb as in the West Indies or other more northerly islands in the Pacific. So band openings to the heavy amateur concentrations in the Northern Hemisphere are shorter and not as strong as those enjoyed by his competition in the tropics. And the absolute lack of any local contacts makes serious contesting difficult. Easter Island is no place to go to win an amateur radio contest, despite the extra 20 dB the CE0 callsign imparts.

"Besides," Father Dave reminds his visitors, "Sunday is my busiest day."

Father Dave shows some of the signs of the hard-core DXer: His greatest fear is that he won't get on the Honor Roll before Easter Island loses its status as a separate country.

Easter Island no longer a separate country for DXCC? Father Dave explains, "Continental drift is sweeping Easter Island toward mainland Chile at the rate of 2 inches per year. We'll be within 225 miles of Chile and lose our status as a separate country in only 70 million years. I hope I can work the last 47 countries I need before then."

How can you increase your chances of working Father Dave next time he shows up on 15 meters? Maybe you should review the phonetics for your callsign.

CHOOSING YOUR PHONETICS

(This part of the column is for phone operators only; we'll get to the CW crowd in another column.) Proper choice of phonetics can spell the difference between success and failure in DX pileups. How do you choose the most effective phonetics for *your* callsign?

Think about why you use phonetics: The purpose is to reduce ambiguity. So many letters sound the same in the English language: b, d, e, t, p, g, c, v, z. Even under perfect conditions, most DX stations confuse stateside calls. In the confusion of a typical phone pileup, these letters are impossible to tell apart. So you turn to phonetics.

You want the DX station to recognize (and come back to) *your* callsign, and hopefully before he comes back to someone else's. So your phonetic callsign should be unique, it should reduce confusion, and it should be easy to copy through the pileup. Does your phonetic call meet these objectives?

THE CHOICES

The first place to look for phonetics is the standard list found in any amateur radio handbook or training manual. This standard list is remarkably good, but it does have a few problems for DXers. One example: After making thousands of contacts as WA1SQB, I would like to personally throttle the idiot who picked "sierra" for S. Sierra is C. I still hear sierra and write C. "Sugar" gets through as well as sierra, without the ambiguity.

Short phonetics punch through pileups faster than long ones. The amateur who uses short, punchy phonetics can get his call in twice as often as the ham who uses longer ones. Guess who works more DX? "Fox" is vastly preferable to "Florida." And the DX station can fall asleep or, worse, work someone else, while I struggle with "Washington American One Santiago Quebec Bolivia Portable Victoria Portugal Nine."

Which brings us to another possible source of phonetics—place names. Place names make long phonetics, usually too long for pileup situations. But they can be used to good advantage in poorer conditions or to confirm a callsign. All place names share a common disadvantage as phonetics, however. Upon occasion they cause more confusion than they eliminate! Witness my callsign above, and the DX station answers, "The station in Bolivia, stand by. The Portuguese station, go ahead!"

One well known contester turned this problem into an advantage. WA1KID would often break through pileups with "WA1KIDelaware." Ethical DXers frown on such use of deceptive phonetics, however, and you will quickly find this practice leads to more harm than good.

A final hunting ground for possible phonetics: "cute" or catchy phonetics. Such as Black White Yellow, or Whiskey One No Good. Or the famous Cute Enema Seashore. Topical phonetics fall into this same category. When the race horse Seattle Slew won the Triple Crown of racing, K7SS tried Seattle Slew for phonetics.

How do you choose the best phonetic from this assortment? We'll examine how you "fine-tune" your individual phonetic for your voice and station next month.

LETTERS

THE LAST TRAGEDY

Shortly after the article "The Father of FM" (February, 1982) appeared, I thought I'd look-see for myself. Perhaps a few pictures would be in order. Sure would be nice to add to the club history (the Major Armstrong Memorial Radio Club, Alpine, NJ, on the site of the tower described in his later experiments). Several passes were made to find the location, and at last I found it hiding ingloriously behind a huge apartment, the number, 1032, hidden under many coats of paint and hard to distinguish.

There above me on the hill to the east she stood, empty, burned, and blackened, overgrown with weeds and unattended flora, alone, abandoned, utterly destroyed. Though windows below were boarded, the door swung freely in the winter wind; a foreboding feeling crept over me as I entered.

Local youths, it appeared, had added their mark to the already sickening sight. Fearfully I entered, as one would an unknown tomb, feeling the evil of such a deed. Slowly, I climbed to the room where it all began, up the main stairs which, under the paint removed by the heat, showed a lovely balustrade—the kind so many are now restoring back to the way they used to be.

If only it had had a chance, it too could have been restored as have been the homes of many of America's lesser heros, but the shame of the Bronx has reached a few miles north into Yonkers.

There before me was the room—the one with the three windows—where it began. The sounds of those words rang in my head and lifted up into the sky above. Open into the universe. Another tragedy in the tale of Major Armstrong unfolded before me and you.

And so the last tragedy in the life of Major E. H. Armstrong passed one cold December 16,

1032 Warburton Ave., Yonkers, at present. For "then," see p. 51 of the February, 1982, issue.

1981, shortly after 8:00 am, carried by the heat and smoke into eternity.

God bless his memory.

Art Bonte W2ZYC
New Milford NJ

SIX-METER NETS IN DC

The Metropolitan Communications Network Radio Club of the greater Washington (DC) area operated a repeater on six meters (52.250 MHz in; 53.250 MHz out). We would like to have repeater clubs operating six meters anywhere along the eastern seaboard contact us to establish some linkage and exchange experiences. The six-meter FM net meets Saturday at 1900 hours local time. We also have a six-meter AM net which meets Sundays at 0900 hours local time on 50.4 MHz. Sunday at 1900 hours local time we have a six-meter sideband net which meets on 50.125 MHz.

Robert Sporn WA3GGO
Corresponding Secretary
9927 Cottrell Terrace
Silver Spring MD 20903

WRITE FOR RIGHT HAMS

As a regular reader of your excellent publication, I enjoy reading your often-controversial editorial comments and the letters page, but I have now been forced to write on behalf of the large number of amateurs outside the US without whom there would be no DX. It seems that all your comments do not take any account of the very important international-contact part of our great hobby. Please bear in mind that you are no more a representative of the radio amateurs than is the editor of the *Washington Post* or the *London Times* of their respective readerships, and please take us DX operators into account.

I would also like to comment on some aspects raised in your issue of March, 1982. Concerning your promotion of a no-Morse license, I am definitely against this, especially as we in Britain have had a no-Morse VHF license for some years. As I operate both in the US and at home on both the VHF and HF bands, I have noted that despite the much larger number of US amateurs, you have a much smaller proportion of lids. Have you ever listened to the London repeaters? Also, the operating standards of US amateurs to me are much higher than the average, especially on CW. I am sure that this difference is a result of your Novice system, that I would like to see copied in the UK.

This brings me to my next subject of emergency communications, although nobody can fault your suggestion for a national data network (international?) for traffic handling. I believe that once main power supplies have gone, as they certainly will in a conflict, we will be back to CW. I believe that we should propagate some return to basic, but modern, technology in amateur radio coupled with CW operating so that in the final emergency we amateurs can salvage some communications from the remains.

Andy Hewitt G3SVD/W4
Thatcham, Berkshire, England

I can see you've never tried our repeaters in New York or Los Angeles. I monitor the London repeaters when I'm there. . .no comparison to the antics we are able to generate. Andy, where are we going to get all those CW rigs? Most of the SSB and FM ham gear these days can operate from a car battery as well as the mains. A large part of the emergency gear is mobile and hand-held equipment anyway. I can just see us all sitting there with a hand key sending messages via our handie-talkies. Perhaps some forward-looking firm will come out with a hand-key kit to provide keys which will screw on to our HTs in case of emergency need. We could even have the code printed on it for those of use who have forgotten the code.—Wayne.

A RIGHT HAM WRITES

I think that you ought to write a couple of things about Novices. I'm 12 years old and I'm a Novice. I see a lot of articles on things pertaining to General class hams but nothing about us Novices. Thanks for your time. I think your magazine is great!

Eric Farwell EF2XJI
Miami FL

Eric F., you are absolutely right! Let's see some more articles to help our Novices understand more of what is going on. We need to get them interested in simple antennas and how they work, introductions to some of our more exciting activities such as traffic handling, SSTV, ATV, RTTY, certificate hunting, contests, and so on.—Wayne.

NO MORSE A NO NO

I am writing in disagreement with your feelings about CW. Evidently you don't operate CW. I operate CW and enjoy it. I am 14 and was first introduced to ham radio when I was 11. I was attracted to ham radio because of CW; it seemed interesting. I was not scared off by CW when I was a newcomer. I work lots of CW. I do also work SSB and enjoy it, too. CW is *not* (for most) just "the usual garbage of name, location, signal strength. . ." etc., as you stated in an answer to a letter in the April, 1982, issue. I'm a ragchewer and do mostly that, though I do some DXing and contesting. I don't just give my name, QTH, etc. I talk about my family, the day, school, my future, electronics, etc. CW is fun and rewarding. CW is the root of ham radio. CW is what makes ham radio special. I am *completely* against "no-code" licenses; the last thing I want to hear is ham radio sounding like the Chicken Band (CB). So my conclusion is that CW is fun and thoughts *are* expressed on CW.

Eric Lassiter KA4KEG
Danville VA

Hey, Eric L., I'm glad you've found some chaps on CW who will give you more than the usual dull routine. That's great! Not that I can in any way single out CW for that crime. It's all too prevalent on our repeaters, and certainly not unknown on our DX bands. And I don't know of anyone who wants to have our ham bands sounding even more like CB than they do, so stop fretting about that. Perhaps I put more trust in the intelligence it takes to understand radio theory than I do in the skill it takes to copy code. I do know that you would be hard put to point out any of the more serious offenders on our bands as being good technicians. I tend to gravitate more toward hams with technical backgrounds, and to find them the most sincere and fascinating of all hams.—Wayne.

NO CODE A YES YES

Sir, I sincerely applaud you for your editorial in the March, 1982, *73 Magazine*. I find your logic in a no-code ham ticket as being beyond reproach and agree whole-heartedly with your comments. Do not give up on this, as you will prevail.

One of the most frustrating experiences I have had has been wanting to get a ham license and to do experimentation in communications. As a result of this frustration, I turned to CB radio. Most everyone knows there is a problem on 11 meters, but fads have a way of fading away, leaving only those that are sincere. The only drawbacks in my getting into ham were two items, one a myth and the other what now should be a legend, to wit: you had to spend a lot of money on equipment, and code. As has been evidenced, you can get on the air in a respectable manner without having to sell the wife and kids.

The other item, code, is rhetoric used by the elitists to keep it all to themselves.

Selfish and unconcerned as to the future of ham radio: "I had to do it, so should you," attitudes. If we were to use the logic many hams profess, we'd still be in knickers until manhood, women would not be able to vote (hmmm), and we would have legal slaves. Trying to keep code as a requirement is analogous to keeping a person on a respirator who has suffered "brain death."

I cannot for the life of me find any logic in the license requirements for code. 5 wpm, Novice, CW only; Technician, CW and phone on some VHF; 13 wpm for General and Advanced for. . . *phone* privileges? Like putting the cart before the horse, bass ackwards. In any case, code should be like blacksmithing, an art of an outdated requirement. Those who want it, do it; those who don't, won't. Code, like saving string, serves no useful purpose but you keep hanging on to it.

We need technical innovations and experimentation by those who sincerely want it while, on the other hand, providing a hobby to many. I am trying to get our local Community College to carry a non-credit course in the aspects of ham technology. So far no luck, but I will continue to try. I feel that we as Americans need to recapture the reputation for being leaders in technological advancements rather than also-rans. To do this,

we must take down our self-imposed barriers and "motivate, not frustrate" (a good anti-code slogan) new blood into ham.

I'll learn the code in order to upgrade, but I will then drop it like a bad habit. I guess that means some people will label me as a lid or other terms they put on those who want to move forward, not stay in the past. If people would sit down and unemotionally analyze the no-code proposals, using reality, and not negatively speculate on what would happen, only positive things could come about. For those who cannot follow the rules and regulations as set down, what we need is stronger enforcement of the rules, not outdated requirements such as code.

FCC has its heart and hands full in light of the budget cuts, etc. It needs help in enforcement of the rules. This could be accomplished by the use of hams themselves. Testing could be done on a local level by a group or club of hams. In my case, I would have to go to Long Beach, California, to upgrade. This would cause me to miss two days of work. Or, glory be, I could wait to see if the field office will have enough money to make a trip maybe 2-3 times a year to come to where I live.

Using local hams to upgrade future hams would also instill pride. It wouldn't take long to find out which groups are upgrading really qualified hams, as the proof is in the pudding. Nothing wrong in taking pride in knowing that your pupils have been properly supervised, instructed, and motivated in the correct methods and knowledge. However, the clout is in the hands of the diehards who insist on being outdated in putting political pressures on those who can change the code requirement. Until these "chosen" pass away to that great shack in the sky, I am afraid that the code will remain, regrettably.

There are so many positive aspects to dropping the code; if only those who wish to hold on to the past would take a *positive* view. Let's move ahead and become the leaders of advancements, not the sleeping giants that we are.

Frank J. Ward KA7LXT
Tempe AZ

Troublemaker.—Wayne.

HANG HI OL' YAGI

Even I can remember the time when one needed a yagi or a quad to work DX, the thrill of breaking a pileup, the sophistication of dual vfo's, tail-ending, and all the rest of that good stuff. To the new breed of ham, this sounds like weird talk indeed. The new DXer thinks you're out of the band when he hears about stacking five-over-five on a 180-foot tower. Who needs it? And he's right! These tales of working DX with yagis and amplifiers sound like echoes of the past, like the mumblings of bearded Honor Rollers about the gud ol' days. The new DXer knows where it's at. . .you won't find him staying up half the night in the hope of catching a rare one while the rest of the world sleeps. He's not going to spend hours calling CQDX in the hope of finding a rare bird. Hell no, he'll tune in to a DX net, of which there are now more than thirty. He'll get in line and work the rare ones without any fuss. "Like a telephone call," says one list-taker. "No cuss'n and scream'n."

We old goats have been taken in by the manufacturers, i.e., we were told it was necessary to have a beam and an amplifier if one wanted to be a successful DXer. Well, it took me five years to discover that all one needs today is a worry-free dipole and a barefoot transceiver and you can work the world.

Like an archaeological relic, a dinosaur crying out for a mate, I called CQDX today for twenty minutes on 15 meters and nothing came back. There I was with a fortune tied up in amplifiers and towers, yagis at 150 feet, and two-inch heliax. Nothing came back, so I spun up the band and there they were, twelve of them, all 5 and 9, and all semi-rare: D68, ZD7, EA8, EA9, 7Q7, 3V8, JW, and more, all sitting like clay ducks in a shooting gallery. One after another they came back to the squeaky off-frequency signals with 4 and 3 reports. (The callsigns were handed out by the control station to the DX station. Reason: speed and efficiency, of course, of course!) And what's more, everybody was happy. The gud ol' list takers stood by for the indoor dipoles and verticals. Only one guy failed to get his report, and he was using a mag-mounted Hustler whip on his rig in the basement. . .he said he would wait for propagation. (Gud man!)

We with the mile-high yagis and maximum-limit amplifiers are anachronisms, incongruities at this point of time. Down will come those relics of the past and up will go the trouble-free dipole or vertical, and out will go the amplifier. That stuff belongs with chrome-laden, 6-litre guzzler automobiles and 25-cent-a-gallon gas. Get with it, DXers, you're showing your age! Pileups are on their way out, the way individuality is out and organization is in. CU on the lists.

Don Newlanda VE3HGN
Colborne, Ontario, Canada

You don't have to be an old-timer to remember the days when men were men and the endorsement sticker belonged to the strong and the quick. But now the demand for DX is way ahead of supply. A DL can raise a huge 10-meter pileup on a weekday afternoon. Rare ones who prefer to avoid the melee turn to lists. What to do? Try contesting, where the big station is worth the trouble. There's still a place for your 8877s, Don.—WB8BTH.

IT DOESN'T COMPUTE

The basic reason for not renewing my subscription to *73 Magazine* is because I feel that Wayne Green is using it to further the use of computers and associated software for communications between hams. This, I feel, reduces the human touch involved in everyday hamming. Taking away the personality of the ham and replacing it with machinery will indeed make everyone bored with the hobby. This leads to reduced growth, which is the opposite of that which Wayne is trying to achieve.

We do need growth in our hamming hobby. This will not be denied. But to substitute computers for the personal touch is not going to hack it. Contesters, DX hunters, county hunters, and rag-chewers thrive on the personal satisfaction that comes from doing it themselves. From learning a new langauge—Morse code—to building their own projects, no matter how simple or complex, each and every ham has his goal within sight and obtainable. It only depends on his ability and determination to do so.

Wayne professes that involvement with computers will revolutionize the hobby. He is absolutely correct. It will do what he wants. It will have hams all over the world making contests no more complicated than picking up the phone and dialing across the states. If that's what hams want, then why are they spending their money on better antennas, higher towers, new radios, or any other gadget that they think will make their contacts better or stronger than anyone else's? Why don't they spend it on computers and software and take all the grief out of hamming?

Computer hamming will eliminate personal satisfaction, which will in turn eliminate the desire to be an amateur *radio* operator.

Jim Ory WD9ATJ
Plainfield IL

By golly, Jim, you are probably right! We just may be able to make it so amateur radio can be enjoyed by people who haven't the kilobucks to put up monster beams and run 10,000 Watts, as you seem to prefer. We might even be able to cut back on those fun pileups which have chased most of the DX operators off the air from rare countries. But just maybe the nuts who think a new country is worth getting killed for can be siphoned off into ever more complex automatic country working, thus leaving the bands more open for getting to really know some of the DX operators. You know, the FCC was opposed to letting computers into amateur radio, too. It apparently never occurred to them that, like a typewriter or a Teletype® machine, there has to be an operator. . .a live person. . .behind each computer. The computer is just another means of communicating, little different from CW, RTTY, and so on. It turned out that the FCC chaps had virtually no understanding of the situation and were acting normally . . .fighting any efforts by hams to experiment and perhaps provide the world with some progress. Obviously, Jim, you've managed to arrive at your convictions without taking the time to ask anyone involved with

computers about the real skinny. Find out what you are talking about first. . .then think it over. . .then, and only then, go on record. Remember, Jim, that when I write something I know I will be faced with about 200,000 skeptics, each one more interested in blowing a hole in my reasoning than in agreeing with me. . .so I have to be darned sure I have the background to know what I am writing about. Jim, I'm ready to stand up in front of any assemblage of hams and discuss Morse code, its pros and cons. I've been at that for some thirty years now. . .and, as I've said, it has been quite a few years since I've heard anything new. Jim, you haven't the slightest idea of what computers may do to hamming since you haven't tried them. . .and apparently don't know anyone who has.—Wayne.

THE GREAT GRATER

So Wayne the Grate (just a small pun) has again taken up the Holy Grail, this time in the form of abolishing the code requirements for ham licenses.

I admire you for the courage of your convictions, Wayne, but there are more than a few of us out here who have strong objections to a no-code license, myself included.

I am a newer ham (since 1977), an electronics engineering technician, own my own personal computer, and am an active member of the Tucson Amateur Packet Radio Club. I only say this in order to dispel any idea that I am of the "fraternity" that dislikes the introduction of new technology into ham radio.

When I received my ham license in the mail, I felt something that I'm sure no CBer has felt when his permit arrived. That feeling is a sense of accomplishment. I *earned* this license, and it is that feeling that binds me together along with the majority of other hams. A "cut above," if you will. The day that bond is gone is the day that the Amateur Radio Service ceases to exist. All remaining motivating factors will be self-centered, and no longer will hams work for the "good of amateur radio."

But that is not why I write this letter. I enjoy your magazine very much, Wayne, but a couple of things disturb me. First of all, your "Holy Grail" editorials tend a bit toward ranting and raving. That can't be good for the blood pressure or the digestion. I also have noticed that your replies to the letters protesting your editorial views are usually longer than the letters themselves. My psychologist friend has some interesting things to say about that. In short, take it easy, Wayne. This would be a pretty dull hobby sometimes if it were not for cage-rattlers like you, so try to rattle softer, so that you may rattle longer.

Dave Barnhart WB7OBG
Glendale AZ

Dave, I enjoyed your letter. But you should understand that no matter how much the cages rattle, I'm sitting here grinning. My blood pressure is fine. . .I give heart attacks, I don't get 'em. I'm happy that I give the impression that I'm real serious about all this. Oh, I do think that it is high time to dump the code as a means of keeping enthusiasts out of the hobby. . .and to supplant it with a technical exam which can't be totally thwarted by the Bashes and other cheating systems. If you read the license study manuals I put out, you'll see what I think is best. . . simple theory explanations which anyone can understand. Fortunately, I have reason and psychology on my side. . .and just an interest in getting things improved, not an overwhelming zeal. Zealots are not open to alternative ideas and get all emotionally involved in what they are doing. Oh, I don't expect Morse code to get dumped quickly. . .perhaps some experiments with this on 220 MHz, as I proposed to the FCC about thirteen years ago, to see if we can make the change from a filter of a very slight skill (code) to a not-much-more-difficult technical test. . .without the universal cheating via Bash. My letter answers are long, at times, so I can clarify misconceptions.—Wayne.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

JEFFERSON DAVIS DAY QSO PARTY

Contest Period:
1500 to 2400 GMT June 5

The Pennyroyal Amateur Radio Society is offering attractive certificates for contacts made during this year's annual event. Suggested frequencies are 3730, 3940, 7260, 14310, 21410, and 28610. Requests for certificates or more information should be addressed to Pennyroyal Amateur Radio Society, PO Box 1077, Hopkinsville KY 42240.

WORLDWIDE SOUTH AMERICA CW CONTEST

Starts: 1500 GMT June 12
Ends: 1500 GMT June 13

Sponsored by *Electronica Popular* magazine of Rio de Janeiro, Brazil, this contest will be held annually on the second weekend of June. Use all bands from 80 through 10 meters on CW only; crossband contacts are not valid. Only contacts between South American stations and stations on other continents are considered for scoring. A station may be worked only once on each band. Entry classes include single operator/single band or all bands, and multi-operator/single transmitter (multiband only).

EXCHANGE:

RST and consecutive QSO number starting with 001.

SCORING:

Each QSO counts 2 points. Contacts between South American stations count only as multipliers, not as QSO points. For South American stations, the multiplier is the number of different countries worked on each band. For others, the multiplier is the number of different South American prefixes worked on each band. The final score is the sum of QSO points multiplied by the sum of multipliers.

AWARDS & ENTRIES:

Certificates will be awarded to the three top-scoring stations in each class and to the top scorer in each country. A separate log for each worked band must be sent no later than July 31st to WWSA Manager, PO Box 18003, 20772 Rio de Janeiro, RJ, Brazil.

CALENDAR

JUN 5	Jefferson Davis QSO Party
JUN 12-13	ARRL VHF QSO Party
JUN 12-13	Worldwide South America CW Contest
JUN 19-20	Summer SMIRK Party
JUN 26-27	ARRL Field Day
JUL 1	CARF Canada Day Contest
JUL 10-11	IARU Radiosport
JUL 17-18	International QRP Contest
JUL 17-18	**A5 Magazine* Worldwide SSTV DX Contest
JUL 24-26	CW County Hunters Contest
AUG 7-8	ARRL UHF Contest
AUG 14-15	European DX Contest—CW
AUG 21-22	SARTG Worldwide RTTY Contest
AUG 21-22	*A5 Magazine* FSTV UHF Contest
SEP 11-12	ARRL VHF OSO Party
SEP 11-12	European DX Contest—Phone
SEP 18-20	Washington State OSO Party
OCT 2-3	California OSO Party
OCT 16-17	ARCI QRP CW OSO Party
OCT 16-17	Pennsylvania QSO Party
NOV 6-7	ARRL Sweepstakes—CW
NOV 13-14	European DX Contest—RTTY
NOV 20-21	ARRL Sweepstakes—Phone
DEC 4-5	ARRL 160-Meter Contest
DEC 11-12	ARRL 10-Meter Contest
DEC 19	CARF Canada Contest

* Note data change.

RESULTS

73 MAGAZINE
40-METER SSB CONTEST
—Claimed Scores—
(Callsign, OTH, QSOs, Total Contest Score)

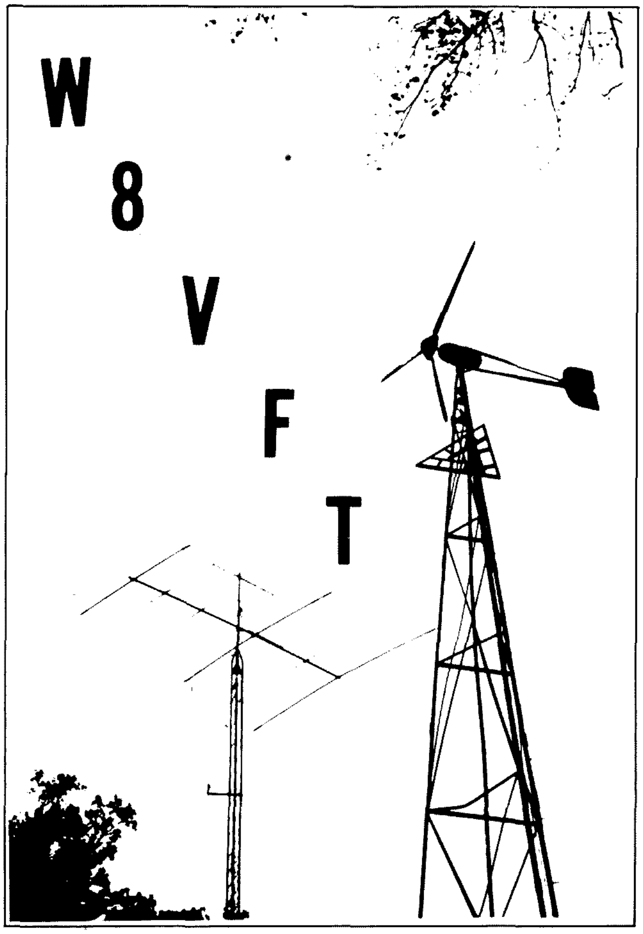
W/VE Single Operator			
VE5DX	Sask.	972	113,240
W9RE	IN	851	105,148
N3AMK	PA	771	99,180
KK9A	IL	856	87,440
KA1XN	MA	761	63,358
DX Single Operator			
YU5ANE	Venezuela	359	65,880
CN8CO	Morocco	361	61,008
H44SH	Solomon Is.	291	37,765
LA5YF	Norway	221	32,319
JA2BAY	Japan	205	28,470
W/VE Multi-Operator			
N9NB	IN	1098	112,965
KD4TQ	KY	972	95,432
VE2ZP	Que.	704	86,355
KJ9D	IN	681	77,868
N4BAA	FL	645	66,392
DX Multi-Operator			
I4YNO	Italy	672	128,800
I5MPK	Italy	590	107,334

80-METER SSB CONTEST
—Claimed Scores—

W/VE Single Operator			
KQ2M	NY	510	60,606
N7DF	UT	700	57,642
K0CS	MO	552	51,435
WB2DHY	NY	346	42,510
VE5XK	Sask.	672	42,222
DX Single Operator			
CN8CO	Morocco	441	67,032
C6ADV	Bahamas	296	21,488
HI8GBG	Dom. Rep.	149	17,052
OK1MSM	Czech.	165	16,640
HI8GB	Dom. Rep.	145	14,484
W/VE Multi-Operator			
N9NC	IN	793	57,652
VE2ZP	Que.	567	42,387
N4BAA	FL	421	36,480
W4CN	KY	564	35,441
KF2X	NY	413	25,488
DX Multi-Operator			
I5MPK	Italy	191	22,184

40/80-METER COMBINED CONTEST
—Claimed Scores—

W/VE Single Operator			
N7DF	UT	1188	180,040
KC4OV	TN	931	147,686
K8AKY	MI	880	141,885
N8ATR	OH	788	104,967
KC8JH	OH	735	100,250
DX Single Operator			
CN8CO	Morocco	802	256,908
H44SH	Solomon Is.	360	71,082
JA1ELY	Japan	196	26,642
VK5BW	Australia	170	17,384
DL8UI	W. Germany	92	8,544
W/VE Multi-Operator			
N4BAA	FL	1066	205,076
KF2X	NY	978	161,604
DX Multi-Operator			
VE2ZP	Que.	1271	249,996
I5MPK	Italy	781	234,136



QSL OF THE MONTH: W8VFT

Sometimes, the design of a QSL card can capitalize on the unusual aspects of your station. It worked for W8VFT and his wind-powered setup. In fact, as the back of the card explains, W8VFT's entire homestead is powered by the wind generator shown on the card!

If you would like to enter our contest, put your QSL card *in an envelope* and mail it along with your choice of a book from *73*'s Radio Bookshop to *73 Magazine*, Pine Street, Peterborough NH 03458, Attention: QSL of the Month. Entries which do not use an envelope (the Postal Service does *occasionally* damage cards) and do not specify a book will not be considered.

SUMMER SMIRK PARTY CONTEST
Starts: 0000 GMT June 19
Ends: 2400 GMT June 20

Sponsored by the Six-Meter International Radio Klub (SMIRK). No crossband contacts, multi-operators, or partial contacts. Check logs or dupe sheets are not needed.

EXCHANGE:

SMIRK number *and* ARRL section, foreign state, province, prefecture, or country. Count ARRL sections in the 48 US states only; KH6 and KL7 count as countries. Washington DC counts as a section as well.

SCORING:

Count 2 points for each SMIRK contact, 1 point for non-SMIRK QSOs. Add QSO points and multiply by number of ARRL sections, foreign states, provinces, and countries worked for final score.

AWARDS:

Trophies for high-score SMIRK in two divisions: US/Canada and foreign. Certificates for high score in each ARRL section and foreign state, province, prefecture, or country.

ENTRIES:

Entries must be submitted on

RESULTS

1981 CALIFORNIA QSO PARTY
Sponsored by the Northern California Contest Club
(Call, CW Qs, SSB Qs, Multiplier, Score)

California Single Ops				
N6TR	310	2063	58	293,248
N6BT	325	1998	57	283,347
N6BV	282	1488	58	221,676
AI6V	0	1855	58	215,180
K6HNZ	0	1659	57	189,126
KI6O	330	972	57	167,238
N6PE	362	882	56	159,600
N6QW	270	933	58	155,208
AA6G	41	1227	57	146,889
AA6RX	89	1085	57	138,909
California Multi-Ops				
AJ6O(M-M)	151	1908	57	243,333
N6AHA (M-S)	105	1298	57	165,927
K6AA (M-S)	274	455	54	93,528
K6YA (M-M)	259	400	53	83,581
KS6H (M-S)	300	341	50	79,100
Out of State				
WD0EWD	168	501	54	81,324
WA0AVL	171	497	52	78,364
N4BAA	141	312	49	51,303
WA5DJK	154	249	48	46,080
WB5YXK	178	149	45	37,440
W1GNR	189	113	44	34,892
K7GM	156	187	41	34,522
W3HDH	152	166	42	33,096
WA1FCN	131	149	47	32,477
KD4XR	0	342	47	32,148
DX Top Five				
SM3DXC	41	1	33	4,125
JA1OP	46	0	23	3,174
JR7TJP	0	53	26	2,756
PY1NEZ	0	61	20	2,440
LU6EF	19	24	21	2,205

the fall, 1981, edition of the official SMIRK log. Single copies are available for an SASE and photocopies may be used. Send log requests, and entries postmarked by July 11th, to Spencer F. Ritchie KA2MHT/5, 5122 Sagamore, San Antonio TX 78242.

NEWSLETTER CONTEST WINNER

After a three-month hiatus, I was called upon again to choose a winner for *73*'s monthly newsletter contest. As usual, I put the task off until the last minute. This time, I was lucky; a "winner" jumped out at me. If you have an opportunity to read this month's choice, *The Log*, published by the Northern Ohio Amateur Radio Society, you'll see why.

The NOARS newsletter is not a one-man show. A rather impressive-looking masthead lists 25 names of officers, editors, and committee chairmen. The theory that many hands, working together, make for a light load applies here. *The Log*'s first page is rounded out by "Inside This Issue," a series of vignettes that make you want to turn the page and start reading.

NOARS editors KA8JRI and N8DNA make sure that there is something for everyone. They include reports for award chasers, the contest crowd, DX hounds, traffic handlers, and Novices. An historical series, "In the Beginning," will appeal to all the readers. A more somber *Log* feature is the "Silent Key" section, which incorporates the QSL cards of deceased members as part of a brief memorial.

In addition to their monthly newsletter, NOARS members receive an annual membership roster and a calendar that has the dates for club activities and operating events clearly marked. All this helps to convey the image of a lively, enthusiastic club.—N8RK.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

CERTIFICATE HUNTERS CLUB

All awards are issued to both licensed amateurs and SWLs on a heard basis.

Requests for band, mode, and power endorsements must be made at the time of your original application and must be correctly indicated on your log extract.

A verified log should be sent in lieu of QSLs. Have your log certified by a local radio club official, two licensed amateurs, or a notary public. Copies of your cards will be accepted in lieu of certification.

● WTP—Work The Pacific. The basic award is issued for confirmed contact with at least 30 countries in the Pacific area as set forth by the WTP country list. Gold seal: A gold seal is applied when 50 or more confirmations are achieved. Award application fee is $3.50 or 12 IRCs; overseas, add $1.00 or 3 IRCs; gold seal after original application, $1.00 or 3 IRCs.

● WTC—Work The Caribbean. The basic award is issued for confirmed contact with at least 20 countries in the Caribbean area as set forth by the WTC country list. Gold seal: A gold seal is applied when 30 or more confirmations are achieved. Award application fee is $3.50 or 12 IRCs; overseas, add $1.00 or 3 IRCs; gold seal after original application is $1.00 or 3 IRCs.

● Gold Seal Plaques. If desired, plaques are available for the WTP and WTC award series. When requested at the time of original application, your award is mounted on a walnut-grain 13" × 16" plaque, for $25.00. (Overseas, add $7.50 postage/insurance.) When requested after your original application, an engraved 4 × 6 solid walnut plaque denoting your accomplishment is available for $20.00. (Overseas, add $3.00 postage/insurance.)

● A-1—Operator's Certificate of Merit. Issued free of cost by the IARS/Certificate Hunters Club to amateurs observed displaying a high level of achievement in various areas of amateur radio. The award is also issued upon receipt of three nominations from three different amateurs in three different geographical locations. So, if you feel that an amateur should receive this honor, get out your pen and give us the details in writing. You do not have to be a member of the club or a holder of the award to nominate.

● County Awards. Issued in multiple classes for the differ-

ent numbers of counties confirmed, in 14 states. GCR apply; fee is $3.50. The awards measure 8½" × 11" and are printed on a fine parchtone bond. Other county awards will be made available as demand requires.

- 10 K and 20 K Awards. Issued for confirmed contact with 10 or 20 different locations outside the United States operating with a W, K, or N prefix. Award fee is $2.00 and band and mode endorsements are available.
- Work A-1s. Requires applicant to work A-1 operator certificate holders of any radio organizations issued for WAC, WAZ, WAS, WPX and DX(CC). All rules are the same as they are for the regular award. Award fee is $2.00 and band and mode endorsements are available.

For applications and additional information, send an SASE to the CHC Manager, Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

WORKED ALL VE

Sponsored by the Nortown Amateur Radio Club of Willowdale, Ontario, the WVE Award requires the applicant to work two different stations on two different bands in the eight sections, VE1 through VE8. All contacts must have been made from an area within a radius of 150 miles of one point on and after January 1, 1939.

A sworn affidavit and certification by a local radio club official must accompany your application. Also, be sure to send all sixteen QSL cards, two from each section, along with $1.00 and sufficient return postage for the return of your cards. Address your application to the Nortown Amateur Radio Club, Box 146, Station A, Willowdale, Ontario, Canada M2N 5S8.

The Nortown organization also sponsors the WACAN (Worked All Canada) Award. Here the applicant must work two different stations on two different bands in each of the following twelve areas: VE1 (PEI), VE1 (NS), VE2, VE3, VE4, VE5, VE6, VE7, VY1 or VE8, VO1, and VO2.

All contacts must have been made on or after January 1, 1949, and a 150-mile rule applies, as mentioned for the WVE Award.

Send your list of contacts and QSL cards, with $1.00 and sufficient funds for the return of your confirmation cards, to the Nortown ARC.

TRANS-CANADA AWARD

The Canadian DX Association writes to tell us about their very beautiful award. To qualify, you must work each of the eight VE call areas, with five contacts in each area. In addition to that, another five stations must be worked in VO1 and/or VO2; one VEØ maritime mobile station must be contacted. One of the five VE8 contacts required must be from the Yukon Territory and one must be from one of the offshore islands of the Northwest Territories. In short, a total of 46 contacts must be made to meet the minimum requirements.

WAC 2-80 AWARD

Sponsored by the Metro Amateur Radio Club of Downsview, Ontario, the Worked All Canada 2-80 Award was originated in November, 1972. All contacts and confirming cards must be dated on or after that date.

To qualify, the applicant must submit QSL cards to verify two-way contact with one station possessing a two-letter call in each of the twelve Canadian sections. Are you wondering what the 2-80 stands for? Well, it means all contacts must be made with stations *only* with two-letter calls, and these contacts *must* be made only on 80 meters. Required sections include VO1, VO2, VE1 (PEI), VE1 (NB), VE1 (NS), VE2, VE3, VE4, VE5, VE6, VE7, and VE8. There are no mode restrictions, but endorsements will be granted at the time of applications if all contacts were made on a specific mode of operation.

Contacts must be made using your own equipment from one location or from within 150 miles of it and within the same section.

To apply for this award, enclose $2.00 and sufficient postage for the return of your award and the required confirmation cards. Address all your correspondence to the Metro ARC, PO Box 352, Downsview, Ontario, Canada M3M 3A6.

ALL NOVA SCOTIA COUNTIES

The Nova Scotia Amateur Radio Association is proud to announce the WANS Award, which requires the applicant to work fifteen of the eighteen counties in Nova Scotia, Canada, or fourteen of the eighteen counties plus a contact with Sable Island.

There is no charge for this award, but applicants are asked to send QSL cards and log data along with sufficient postage for their safe return. Address your application to Mrs. Christine Weeks VE1AKO, PO Box 47, Rural Route 1, Cleveland, Nova Scotia, Canada B0E 1J0.

The Halifax Amateur Radio Club also sponsors a Worked All Nova Scotia Counties Award which states that maritime provinces must contact seventeen of the eighteen counties in the province, while at the same time they must contact ten counties on a second band or series of bands. In all cases, Sable Island can be used as a substitute.

To qualify, all contacts must have been made on or after January 1, 1977, and the application should be sent directly to the Halifax ARC, PO Box 663, Halifax, Nova Scotia, Canada B3J 2T3. There is no charge for this award, but the applicant must supply sufficient postage for the safe return of confirmation cards.

DIPLOMA OF THE FRENCH AMERICAS

From Quebec City, Canada, comes word about the French Americas Award which requires stations in Europe, Africa, North, and South America to work at least two FP8 stations, two FY7 stations, and either an FS7 or FM7 station. Applicants in Asia or Oceania must work only a single contact from the areas of FP8, FY7, and FS7 or FM7.

There appear to be no date restrictions, and applicants may have their list of contacts verified by a local radio club official and sent, along with an awards fee of $1.00 or seven IRCs, to Alex Desmeules VE2AFC, PO Box 382, Quebec City 4, Canada.

QUEBEC CITY AWARD

Speaking of Quebec City, Quebec, the local amateur radio fraternity sponsors the Quebec City Award for American and Canadian stations which make a minimum of five station contacts in Quebec City.

You may address all correspondence to the Radio Club of Quebec, PO Box 332, Upper Town, Quebec City, Quebec, Canada. The award fee is $1.00 or seven IRCs.

WORKED ALL SASKATCHEWAN PROVINCE

The Regina Amateur Radio Association is pleased to announce the WASP Award which requires the applicant to accumulate a total of 100 points to qualify. Members of the Regina organization count 10 points each to a maximum of five contacts made with members of the group. Contacts with other Regina amateurs score five points, while contacts with other Saskatchewan amateurs count two points. There must be a minimum of ten QSOs made. Send your list of contacts along with your confirmed QSLs and $1.00 to RARA Club VE5NN, 2827 Abbott Road, Regina, Saskatchewan, Canada S4N 2J9.

STONEHENGE USA

The Tri-City Amateur Radio Club will operate a special event station Saturday, June 12, 1982, from the replica of Stonehenge located near Maryhill, Washington. W7VPA will operate from 1600 to 0100 UTC on or near the frequencies of 3.900, 14.290, 21.390, 28.690, and 146.52. An attractive certificate will be awarded. Send QSL info and $1.00 to W7VPA Special Event, PO Box 73, Richland WA 99352.

HOMEWORK NET

Are you a teenager? Or still think you are? Then the Homework Net is for you, operating on 7.250 phone every Saturday from 2100 to 2200Z. It is designed for, but not limited to, teenagers. This net is looking for young amateurs who wish to make new contacts with people who have similar interests. So take a break from your homework and join us on our informal Homework Net—Diane WD9DNQ and Scott KCØNF.

WATERLOO DAYS

The N. E. Iowa Radio Amateur Association will operate special event station WØMG in conjunction with activities celebrating My Waterloo Days, on June 12-13. Activity will take place from Waterloo, Iowa, and will be on 7.240, 14.290, and 21.370. Special informative commemorative QSL card for SASE to: NEIRAA, PO Box 92, Waterloo IA 50704.

DUNGEONS AND DRAGONS

New! A 10-meter Dungeons and Dragons Net at 28.720

± QRM. Saturdays promptly at 1500 GMT. To save us time and grief, please be ready with your character, rank, dice, and all of the necessary info. Net control is KA9JOX. If you don't hear anyone at 28.720, check 28.820. If still nothing is heard, the net has been canceled because of poor turnout or other reasons and will resume the next week at the same time and place. If you wish to participate regularly, please write me so you can get a chance to be a DM or net control. Address: Michael Frost KA9JOX, Box 1008, Riverside IL 60546.

FORT DELAWARE

Fort Delaware, on Pea Patch Island, Delaware, will be the site of a mini-expedition by Wilmington area hams on the weekend of June 5 and 6, 1982.

This will be the first HF amateur operation from the fort in the middle of the Delaware River where, during the Civil War, many thousands of Confederate prisoners of war were held. The fort is now a state park.

Equipment will be limited to one transceiver fed by a small generator carried to the island by a small boat. Operations will be in the General segments of the HF bands, daylight hours only, with each operator using his own call and the Fort Delaware identifier. Members of the Independent Amateur Radio Group of Delaware will be Rick KB3PD, Allen KB3HZ, Dwight N3ARU, Ned N3ARV, and Doug N3ACU. Commemorative QSL cards will be issued to contacts supplying SASEs.

For more information, contact the Independent Amateur Radio Group of Delaware, 400 Fifth Ave., Millcreek, Wilmington DE 19808.

NOARS AND *USS COD*

Once again, signals will be radiating from the submarine *USS Cod*. Members of the Northern Ohio Amateur Radio Society will be operating from this proud WWII warship during the months of June, July, and August, using the call K8KRG. The *USS Cod* is on permanent display in Cleveland, Ohio. Operations will begin on Memorial Day and run every weekend (with the exception of Field Day weekend) until Labor Day.

An attractive certificate will be awarded for two-way contacts from the ship upon receipt of QSL card and $.50 for postage. Look for operations in the lower part of the General bands, 10 through 80 meters, on the weekends of June 5-6, July 17-18, and August 7-8; we will be operating 40-meter Novice band at 7.125. Send QSLs to Donald L. Winner WD8RZG, 8927 Torrance Ave., Brooklyn OH 44144.

NORFOLK TRICENTENNIAL

The city of Norfolk, Virginia, will be celebrating its tricentennial this year. As part of the "Harborfest" celebration on June 11-14, the Tidewater area amateur clubs will join together to operate a Harborfest-Tricentennial special event station. The amateur call W4NV will be used, and special QSL certificates will be sent to all contacts made who send a large (8" × 10") SASE. The station will operate 24 hours each day in the 80- through 2-meter bands and will work CW and SSB.

For further information, please contact Bill Verebely KC4YX, 3101 Petre Road, Chesapeake VA 23325.

LARGEST TRAIN ROBBERY

The Libertyville and Mundelein Amateur Radio Society (LAMARS) will operate W9HOQ from Rondout, Illinois, near the site of the largest train robbery in United States history. Approximately three million dollars in negotiable instruments and jewelry were confiscated during a brief stopover and all participants were apprehended within six months. Frequencies: phone—7.260, 14.290, 21.375; CW—7.125, 21.150. Time: from 0000Z 12 June until 0000Z 13 June. Certificate for a large SASE to: KB9BR or "Big Robbery," Box 656, Libertyville IL 60048.

STAR-SPANGLED BANNER SPECIAL EVENT STATION

WB3KUH will operate a special event station from Fort McHenry, Baltimore, Maryland—the birthplace of *The Star-Spangled Banner*—on June 12 and 13, 1982. Operation will commence at 1600 GMT. Operation will be within the first 25 kHz of the General and Advanced bands. Both SSB and CW will be used. Novice operation is also expected. Operation will be on 20, 15, 40, 2, and 6 meters.

Stations desiring a special certificate from the event station can obtain one by sending an SASE and their QSO number to Donald Oakjones WB3KUH, 1806 Willann Road, Rosedale MD 21237.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time away from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print (neatly!), double spaced, your request on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I am interested in corresponding with hams who have or had any late-model Hallicrafters equipment, specifically the SR2000 Hurricane transceiver, HA20 vfo, and P2000 power supply/speaker. I am interested in operational notes, modifications reviews, and comparisons.

I would also like to obtain information on the history of Hallicrafters equipment, particularly post-1958. (I already have a copy of the *Ham Radio* article, "The Hallicrafters Story".)

And does anyone have manuals and schematics for a Heathkit IG-72 audio generator and AT-1 transmitter, Hallicrafters S38E receiver, and Eico's 1078 ac power supply, 239 TVM, and Model 315 signal generator? Write before sending.

Robert Gagne
143 Millville St.
Salem NH 03079

I would like to hear from anyone who served at the Naval Radio Station NSS, Annapolis MD, from 1942 to 1946.

Laurence E. Hoepfer N7BJT
Box 334
Columbia Falls MT 59912

I need a schematic for a Hickok Model 19XD signal generator.

Sherman Banks N4CXF
Rt. 1 Youngs Mill Rd.
Kingston GA 30145

Has anyone interfaced an Atari 400/800 to a rig for sending and receiving CW? Is software available?

John S. Lee KA4EPR
12341 Dickinson Dr. W303
Coral Gables FL 33146

I am in need of information about the WWII Navy Model MBM radio.

Tony Grogan WA4MRR
5 Rollingwood Dr.
Taylors SC 29687

I would like to contact anyone who is using the Texas Instruments TI-99/4 home computer to send and receive RTTY, CW, and SSTV.

Miguel Binstok LU1DIU
PO Box 012592
Miami FL 33101

I would like to hear from owners of the code reader made by Microcraft. I need data on how well it works, QRM, etc.

Berand G. Kirschner WB0YCQ
1440 Grand Ave. #11
St. Paul MN 55105

I would like to "marry" my Johnson Invader 200/2000 with a receiver that has a 5.0-5.5-MHz vfo so that I get transceiver-type information. Can anyone help?

Arthur Ford W2HAE
552 Hillside Ct.
Melbourne FL 32935

I need a copy of the schematic for a Hallicrafters S-107 Mark II receiver, built approximately 1961.

Sheldon Daitch WA4MZZ
Box 8091
Greenville NC 27834

improve 73 and our other publications. With our mountains to climb, he could easily take off about fifty to seventy-five pounds and get into fighting trim to help amateur radio get back into a growth mode. What say there, Harry? I know he's always been a very big fan of mine, so let's see what happens.

WHAT'S THAT CLOUD?

Is that a nuclear blast cloud rising over New Hampshire? No, the work on our nuclear power generator seems to have been halted. A clipping sent in from a North Carolina paper (where they put much stock in these things) gives us a hint. It seems that there are more cigarettes per person sold in New Hampshire than in any other state. About 254.4 packs for every person. . . including the kids.

Now before you get the idea that my own efforts to stem the tide of smoking by not hiring smokers is totally ineffective, I should point out that New Hampshire has a lower tax on cigarettes than other states. The result is that Massachusetts (called taxachusetts) people come up here in swarms to buy cigarettes and liquor, both of which are a bargain in New Hampshire.

The gas stations along the border do a land-office business in cancerettes, helping substantially to stamp out life in the great commonwealth just south of us. Liquor is sold in state liquor stores, thus giving us a cut of the action towards lowering taxes. Indeed, we are the lowest taxes state, with no sales tax and no personal income tax.

The only serious problem we have is the air pollution along the Massachusetts border from all those cigarettes.

NO NEWS VS. GOOD NEWS

The recent purchase of *The Daily News* in New York brought back memories of my first visit to *The News*, back in 1938. When I visited *The News* along with my high school class (we often went on field trips to see businesses), little could I have imagined that in ten years I would be working for WPIX, *The News'* television station. Heck, in those days television was a new invention which was being shown at the New York World's Fair. The sets for receiving the few broadcasts were prohibitively priced. In 1938, I was just barely getting going in amateur radio, having been involved for about a year.

The Daily News plant was modern then, with new high-speed presses and row upon row of Linotype machines. The Linotype operators delighted my classmates by making up our names in type slugs and tossing them to us, burning our hands with the hot lead while they laughed.

Hitler was raising hell in Europe and war was brewing. Despite the barrage of propaganda, war was not real to us and it never even occurred to me that before long I might be going to war on a submarine in charge of maintaining and operating all of the complex electronic equipment.

After the war. . . and after college. . . having avoided entrapment by large corporations (a fate suffered by most college graduates which dooms them to mediocrity of income for life), I found myself in broadcasting. First I tried radio *engineering* and announcing. Then, when a spot opened at WPIX for an engineer, I made contact through an old friend Bob Sullivan, who worked as a feature writer for *The Sunday News*.

Bob, a friend of the family, had quite an influence on my life. It was he who introduced me to classical music when I was about seven. He also was a Gilbert and Sullivan nut, which I became, too. I maybe got even by exposing him to country and western, which took with him.

Before we could put WPIX (channel 11) on the air, we had to get some experience. In 1948, there were no unemployed television cameramen to hire. *The News* rented studio space a few blocks from their 42nd street skyscraper at Reeves Sound Studios. Buzz Reeves is reasonably well known today for his incredible contest station. I think they use the call N2AA. Buzz was one of the wealthy hams I talked with when I was looking to start *73 Magazine*. Wisely, he was not interested.

When the studios were finished in *The News* building, we moved to there and finished getting ready to go on the air. We learned to use the cameras, to fix them while operating, to handle the mike booms, and to cope with the various unions which have a vice-like control of New York. The inaugural ceremonies were in the lobby of the building, with me as the cameraman.

It didn't take long before I was nosing around the top floor of the skyscraper, looking for a place for a small ham station. I found an unused room and soon had permission to use it and put an antenna on the roof of the building. I brought up my SCR-522, which was state-of-the-art in those days. Imagine, crystal control! Twenty Watts! Then I put one of the Bill Hoisington (W2BV) 16-element beams up and found myself with a whale of a signal. I could work anything from central Connecticut on down almost to Philadelphia, including all of Long Island. I made thousands of contacts. Hams are still bringing my old *News* building QSL cards to hamfests to flash at me.

Being young and foolish (as differentiated from old and foolish), I wanted to put my beam in the best possible location on the roof of the building. I wanted it out in the open so that I would have a good signal in all directions. Well, the *only* really good place for it was mounted on top of a parapet. I have to admit that I was a bit shaky about climbing out on it to set up the rotator and beam. I had to skinny out about fifty feet, with a 25-story drop on one side and about six stories on the other. Just to help matters, it was windy. It is *always* windy on top of a 37-floor building.

My stint atop *The News* building had lasting repercussions. It was while operating from this aerie that I began wondering what those strange beedle-beedle signals were on the high end of the band. I started asking around and was led to John Williams W2BFD out in Woodside, Queens. John was playing around with radio Teletype®. Being an unrepentant experimenter, I was quickly hooked on RTTY.

John was the father of ham RTTY. He got a lot of us hooked on it in the late 40s. My downfall, if you like to think of it as that, came when I went to work for WXEL, a television station in Cleveland. I was hired on as a television producer and director. They had a mimeo machine, which was a fairly rare item in those days. Within a few days, I managed to get the first issue of a *RTTY Bulletin* out for the few hundred RTTY experimenters. I almost ruined the mimeo machine in the process, but I was started. The *Bulletin* grew into *Amateur Radio Frontiers* and kept going on almost a monthly basis until I became editor of CQ in January, 1955.

The News has changed remarkably little in the last thirty years, which probably is why it was recently put up for sale. The gradual closing of one New York paper after another, often in the wake of strikes, has kept the papers from making much money. That and union opposition kept *The News* from modernizing their equipment. I wouldn't be surprised if they still had some of those old Linotype machines being used to set hot slugs of type. I should get back for a visit and see if any of the old television crew are still there.

Bill Hoisington's fire tower eventually blew down in a storm and he found himself fired from the firm he had worked with for years. The main reason for letting him go seemed to be that he was getting too close to retirement pension age. He went into business writing a long series of simple VHF and UHF construction projects for 73. He moved to Peterborough (as K1CLL) to make this simpler. Following a divorce and some serious ill health, Bill moved to the Philippines and got remarried. He seems to be living happily ever after there, still working on simple home VHF projects.

You know, one of the odd things about operating from the top of a skyscraper or a mountain is that when the two-meter band begins to open, it is the stations on the ground which hear the skip signals first. I would hear New York stations working down into Virginia and North Carolina for an hour or more without being able to hear a whisper of the southern chaps. Then, when the DX was starting to work on up into Connecticut, I would start hearing them and be able to make contact. My elevation had little benefits for that type of contact. There *are* drawbacks to skyscrapers and mountains.

Well, I hope that the new owners of *The News* will modernize it and keep it going. I enjoyed my working there and will never forget the excitement of DXing from that spot.

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Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	21	14A	14	14	7	14	21	21	21	21A	21A
AUSTRALIA	21	14A	14	14	7	7B	7	7	7B	7B	14	14A
CANAL ZONE	21	14A	14	14	14	7	14	14	21	21	21	21
ENGLAND	14	7A	7	7	7	14	14	14A	21	14A	14A	14
HAWAII	14A	14	14	14	7	7	7	14	14	14	14	14
INDIA	14	14	7B	7B	7B	7B	14	14	14	14	14	14
JAPAN	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
MEXICO	14	14	14	14	7	7	14	14	14	14	21	21
PHILIPPINES	14	14	14B	7B	7B	7B	7B	7B	14	14	14	14
PUERTO RICO	21	14	14	14	7	7	14	14	21	21	21	21
SOUTH AFRICA	14	7B	7B	14	14	14	21	21	21A	21A	14	14
U. S. S. R.	14	7A	7	7	7	14	14	14	14	14	14	14
WEST COAST	14A	14	14	7A	7	7	7	14	14	14A	14A	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	14	7	7	7	7	7A	14	14	14
ARGENTINA	21	21	14A	14	14	7	14	21	21	21	21A	21A
AUSTRALIA	21	21	14	14	14	14	7	7	7B	7B	14	14A
CANAL ZONE	21	14A	14	14	14	7	14	14	21	21	21	21
ENGLAND	14	7	7	7	7	7	7	14	14	14	14A	14
HAWAII	14A	14A	14	14	7A	7	7	14	14	14	14	14
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	14	14	14	14	7B	7B	7B	7B	14	14	14	14
MEXICO	14	14	14	14	7	7	7	14	14	14	21	21
PHILIPPINES	14	14	14	14B	7B	7B	7B	7B	14	14	14	14
PUERTO RICO	21	14	14	14	7	7	14	14	14A	21	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	14B	14	14	14	14	14	14
U. S. S. R.	14	7A	7	7	7	7	7	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7A	7	7	7	7	7A	14	14	14
ARGENTINA	21	21	14A	14	14	7	14	21	21	21	21A	21A
AUSTRALIA	21A	21A	21	14A	14A	14	14	7	7B	7B	14A	21
CANAL ZONE	21	14A	14	14	14	7	7	14	14	21	21	21
ENGLAND	14	7	7	7	7	7	7	14B	14	14	14	14
HAWAII	21A	21A	21	14A	14	14	14	14	14	14A	21	21
INDIA	14	14	14	14	7B	7B	7B	7B	14	14	14	14
JAPAN	14	14	14	14	14	14B	7	7	14	14	14	14
MEXICO	14	14	14	14	7	7	7	14	14	14	21	21
PHILIPPINES	14A	14	14	14	14B	14B	7B	7B	14	14	14	14A
PUERTO RICO	21	14A	14	14	7	7	14	14	14	14A	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	14B	14	14	14	14	14
U. S. S. R.	14	7A	7	7	7	7	7	7B	14	14	14	14
EAST COAST	14A	14	14	7A	7	7	7	14	14	14A	14A	21

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair G = Good
P = Poor * = Chance of solar flares; # = of aurora

JUNE

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G/F	2 G/F	3 G/G	4 G/G	5 G/G
6 G/G	7 G/F	8 G/G	9 G/G	10 G/G	11 G/G	12 G/G
13 G/G	14 G/G	15 G/G*	16 F/F*	17 F/P	18 F/F	19 G/G
20 G/G	21 G/G	22 G/F	23 G/G	24 G/G	25 G/F	26 G/G
27 G/G	28 G/F	29 G/G	30 G/G			

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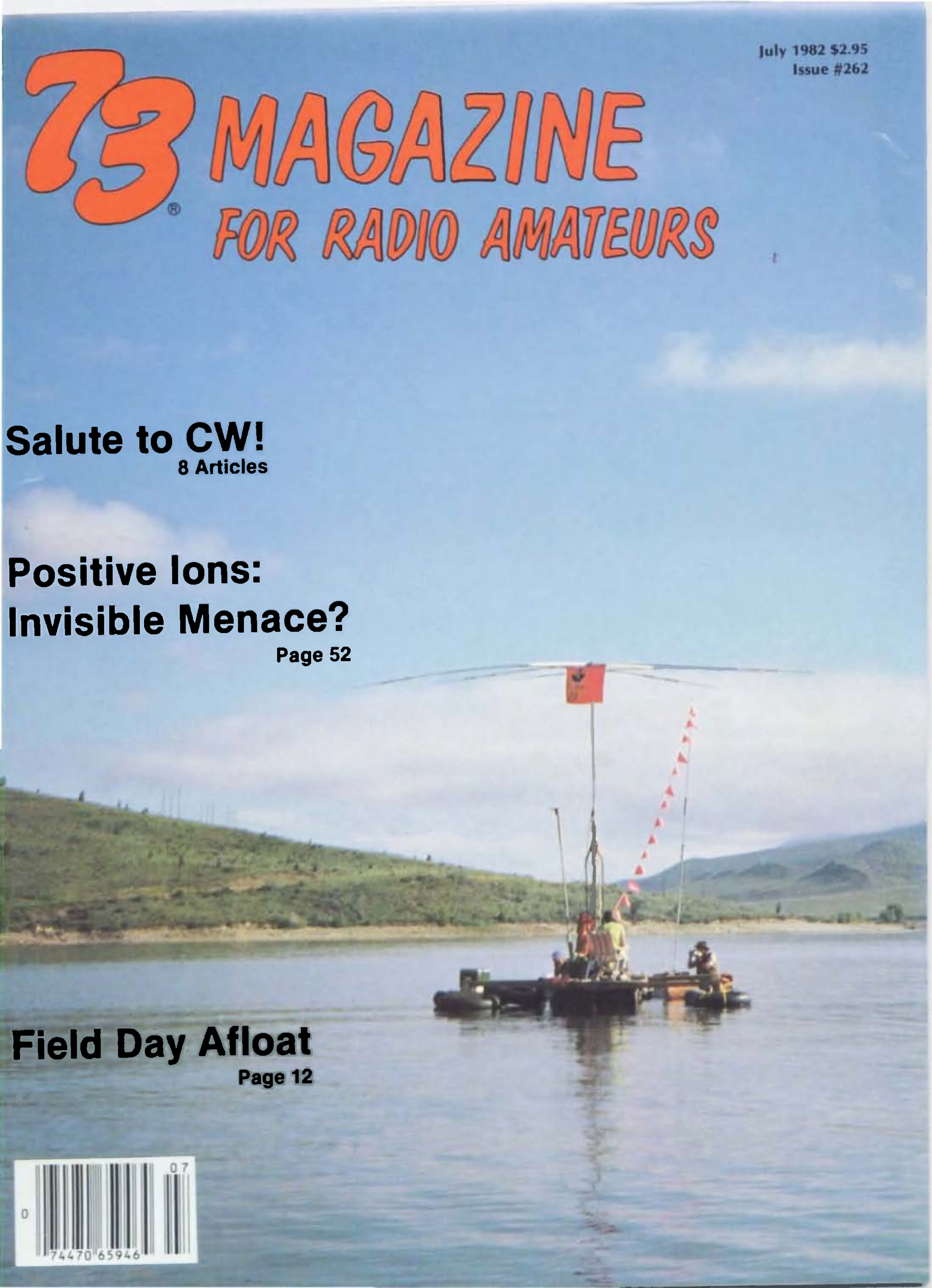
73 MAGAZINE FOR RADIO AMATEURS



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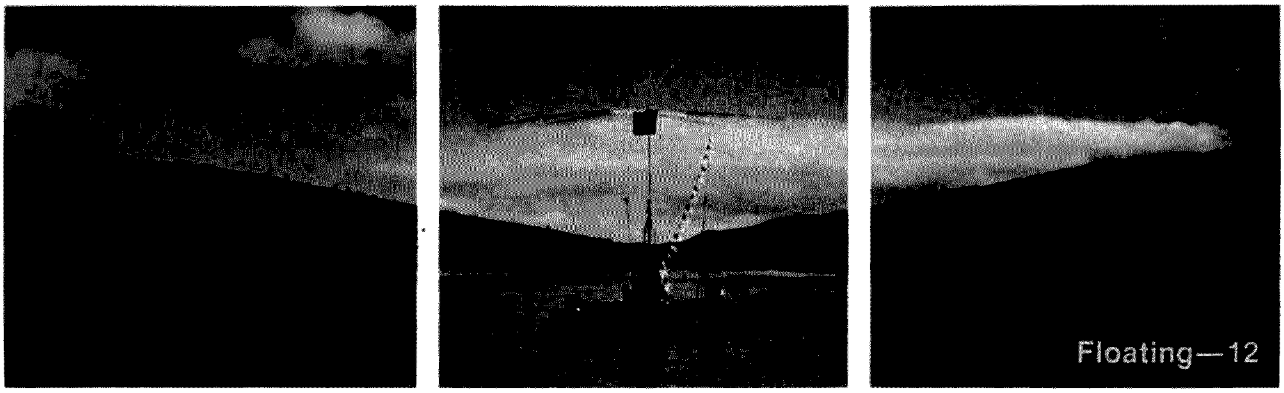

Floating—12

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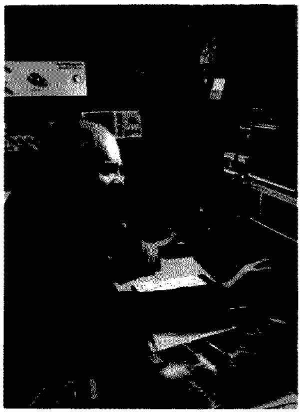

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

DAYTON '82

It isn't just the flea market with over 500 small entrepreneurs selling out of their trucks, campers, and cars. It isn't the nearly 200 exhibitors inside the rambling Wampler's arena. It isn't the 25,000 or so hams and their families which descend upon Dayton in April every year. Pandemonium.

Whenever I hear about some hamfest or a computer show pulling 20,000, I think of what it takes to handle the crowds at Dayton and how many people this really is all in one area. The fields are packed with cars for a half mile or so around the arena area. The cavernous arena buildings are packed with people. No matter how many there are inside, it seems as If the flea market area outside is still so busy that it is difficult to get around.

Dayton attracts average hams from several nearby states. But more than that, most of the real "movers" of the hobby. . . the hams who are doing the building, the inventing, the pioneering. . . come from everywhere in the country. These are the hams who make amateur radio the incredible hobby that it is.

Other hamfests may have technical sessions, but these are attended by merely interested amateurs. At Dayton, the attendance of these tech sessions is made up of the hams who are doing things. Here, one gets to say hello to the top DXers, the DXpeditioners, the slow-scan three-dimensional color experimenters, the packet switching fanatics, and the spread-spectrum aficionados.

While several of the other larger hamfests have gone to rather great lengths to bring in computer-oriented exhibitors, Dayton has maintained a straight ham approach which has kept this field of ham activity at a relatively low profile. Yet this year, when we counted the exhibits, we found that about 15% of them were computer-oriented. This is low, of course, compared to the computer interest in the ham world. Our most recent survey of the *73* readership showed that the ownership of microcomputers is up to 39% now. In another year perhaps 50% of the readers will have microcomputers.

I tried to give a talk during the hamfest, but the meeting "room" was so terrible that I gave up. The temperature was well into the sleep zone and the noise was such that someone three feet away had trouble hearing what was going on. The area was just one part of a huge building, with deafening noise coming from all sides. I don't think I'll try that again. I'll bet it was 90° or more in the room, with only enough seats for about 70% of those who came to hear me.

My talks are generally rather low key, with some time required for the humor to come through. I do speak about serious things, but I don't take many of them seriously. And I don't do well when I have to communicate by yelling at people.

I'll no doubt continue to go to Dayton, but only to say hello, find out what's new, and get together with my friends in the industry.

HARRY, WHERE *ARE* YOU?

Missing for the first time in years at Dayton was the flushed cherubic face of Harry Dannals. I, for one, am sorry to see good old Harry go. And I have to admit that I was darned upset when I learned that the ARRL board just plain outright dumped him. Now what would it have cost them to be nice about it and give him a President Emeritus position?

Dick Baldwin, also not visible at Dayton, seems to have fallen in the same black hole now occupied by Harry, but at least with a face-saving title to make it look better. That's what they did with John Huntoon when the power politics at HQ dumped him a few years ago. Anyone remember John?

You know, one of the surprises I got when I went around to visit some wealthy hams back in 1960 had to do with Dick Baldwin. I'd been fired by *CQ* as editor and had this crazy idea of starting my own ham magazine. I was hoping to find a ham with enough money to get a new magazine started. One chap I visited said he thought the idea was a good one, but that it was too dependent upon just one person: me. He was right about that, of course. He also mentioned that Dick had been around with a similar proposition a few days before.

I dropped Dick a note asking if he might be interested in a joint venture. He wrote back saying no. Well, I went ahead without any financing and Dick never did. Oh, it was nip and tuck for several years, particularly when the ham business fell to pieces after the 1963 ARRL proposal for changing the licensing structure back to the 1930s form. That's when we lost 85% of the sales of ham gear in just one year and all of the major manufacturers were forced out of the industry.

The ten years after that of no growth were hard ones for me and *73*. It wasn't until I managed to sell the idea of FM and repeaters that the industry (and *73*) turned around.

Harry, who had retired from his job at Sperry in order to be available for the General Manager's position, may have to unretire. I wonder what went wrong for him? I'm told by the ARRL insiders that he performed the most exhaustive campaign for the job in history. . . at League expense. Perhaps it was his bitter opposition to having a woman on the board. Well, no matter . . . Harry is well out of the rat race and the demands of the ARRL presidency. I was worried that the even greater pressures of being General Manager might be too much for him. Perhaps he can relax now and add at least twenty years to his life. This may be the best thing that has happened to Harry in years. . . instead of the disaster which it first appears.

INSTANT LICENSES

At long last a solution to the code exam has been effected. Now it is no longer necessary

VOLUNTEERS NEEDED

How would you like to be on the "inside" of a major amateur radio contest? Here's your chance!

We're looking for volunteers to become members of the *73 Magazine* Contest Committee. Anyone with an interest in contesting and a willingness to work hard is welcome. Committee members will help with the following:

1. Contest rules and ethics.
2. Forms and correspondence.
3. Log checking and scoring.
4. Filling out and mailing awards.

Heading up the Contest Committee is Bill KE7C. Please drop Bill a note (with SASE) and let him know where you can help. Write to Bill Gosney KE7C, *73* Contest Committee, 2665 North Busby Road, Oak Harbor WA 98277.

We want *you* on the *73* Contest Team!

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for anyone to bother to learn even one single character of the Morse code to get a ham license. The solution to the code problem is so simple I'm amazed that no one ever thought of it before. Once you get the concept, you see that we no longer have to argue about the code.

At Dayton someone was selling a cassette with the FCC code test on it. With today's miniature cassette recorders it is a snap to have one in your pocket and record the tests as they are being given. Well, someone did this and was selling the tapes at Dayton. Once you have that all you have to do is get someone to translate it for you, memorize the short text, and present yourself for the test.

The FCC is so underpowered these days that they really don't have the personnel to devise a lot of different tests. I'll bet that at best they have maybe two for Morse code, if that many. There are no indications that the Commission is going to get more money from Congress, so it is unlikely that there will be much doing in the way of changes.

So, by the time you put the Bash books together with a cassette of the code test, you have a ham license that anyone who can read and write can get. No more is there a need for that tedious learning of the code. No more struggling with theory or the rules. Bash gives you the answers to the written exam and the code cassette solves that problem.

Who will be the first Extra to get licensed with no ham knowledge whatever? Or perhaps I should ask, who *was* the first?

As a humorous side note: the FCC recently was handed a code test exam which was 100% perfect. Well, perhaps *almost* perfect. You see the answers were perfect for the *other* test...not the one given.

FCC DELETES 97.71 AND 97.74

"Unenforceable, burdensome and unnecessary" is how the FCC described 97.74, a rule requiring amateurs "to provide for measuring the station's emitted carrier frequency and to establish procedures for independently checking it regularly." In their April 1 meeting, the commissioners voted to delete 97.74 and 97.71, a rule which required transmitters operating below 144 MHz to have adequately-filtered plate power supplies. In deleting 97.71, the Commission said "the rule itself is inappropriate and outmoded."

WE NEED KIDS

With all due respect to Bash and his one-day blitz cram courses, at $175 for one day it is unlikely that we are going to get many kids into the hobby via this mercenary system.

Now, I have the greatest admiration for Bash and his bid to outdo Don Miller in making money out of amateur radio. I'm sure he will find no shortage of well-to-do hams who want to get a higher license without having to learn one bit of theory. Just ten of his weekend sessions a year should net him around $150,000. One really has to admire that, no matter what the consequences to the hobby.

His system is simple and it works. He sits you down for a full day of memorizing the answers to the questions. He has you write down the answers you are going to need the following day on the exam...write 'em two or three times to make sure they are well-established in your short-term memory. As an aspiring General or Advanced, you can't lose. Neither can Bash.

All this has absolutely nothing to do with the major crisis in amateur radio: the need for new hams. Novices...teenagers. We already have all of the old men we need in amateur radio—now what we need is to see about 100,000 new Novices per year to get our rusty old hobby jumping again. That would spur technical developments and building (kids really love to build) and get some life into things.

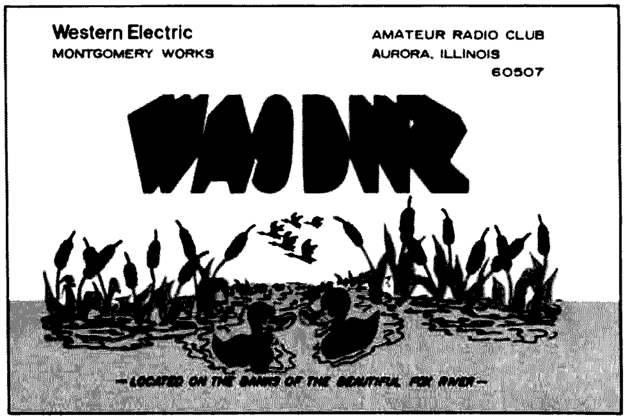
What has your club done to get a ham group started in the local high school? If we don't even give the kids a chance to be exposed to amateur radio, we have no gripe when they turn to drugs, drinking, getting into car accidents, malicious destruction, spray painting everything in sight, and getting all of your girls pregnant. At least give them an alternative!

NAVASSA TIME

The May 3rd issue of *Time* had a nice article on the recent hamming of Navassa Island. As one of the few persistent (stupid) enough to go there twice, I read the item with more than average interest.

The first trip, in 1958 (KC4AF...a call now held by a chap in Alabama), saw six of us chartering a motor-sailer in Nassau and making our way down the Bahamas to Haiti through a heavy storm. We just barely missed crashing on a reef when we got to Haiti before dawn. It was a hell of a trip and we found ourselves about 50 miles off course by the time we

Continued on page 118



QSL OF THE MONTH: WA9DNZ

The natural theme of the Western Electric Montgomery Works club station comes from the plant's location on the Fox River. Built on the site of a former amusement park, the factory is in a wooded setting and sports a year-round duck population. The card's bright colors are sure to catch the eye of the operator on the other end.

Log of the Colorado Queen

—wet, wild Field Day fun

F. Dale Williams K3PUR
5592 S. Moore Street
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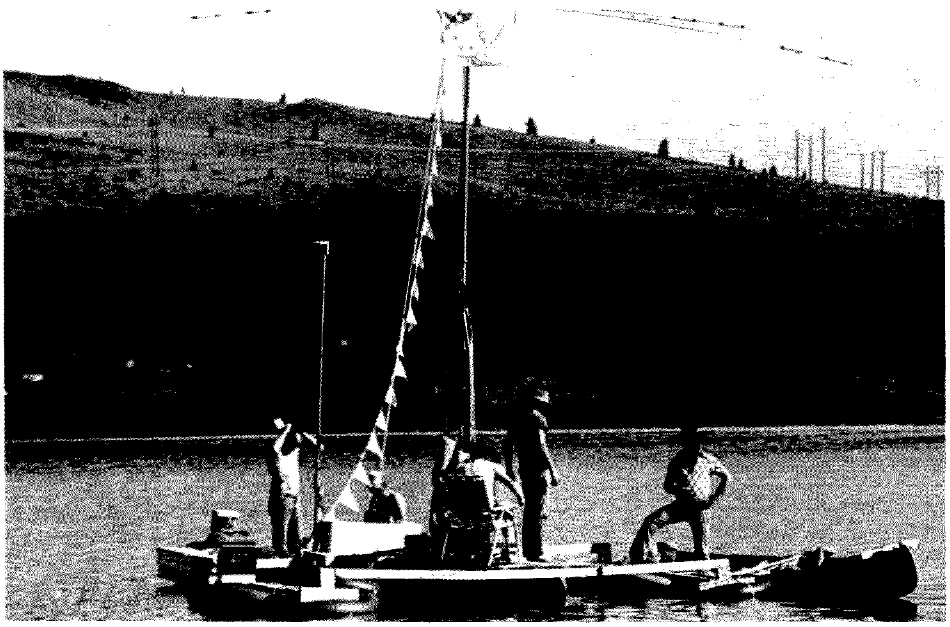
Spring, as reflected in the short-lived green sheen of the foothills, was well settled in the Rocky Mountains when the members of a Denver area amateur radio club gathered to discuss the 1978 Field Day activities. The interests of the club had varied over the years, but the recent increased appeal of contesting and the technical antenna expertise promised in the form of a full-size 40-meter beam to help fill in the propagation holes in 10-20 meters convinced the membership to go all out for top spot in the Field Day results.

Without debating the good and bad points of Field Day, suffice it to say that participation can be divided into two broad classifications—high key and low key. Those groups scoring high obviously are in the high-key category which describes the organization, planning, and pressure required. The pursuit of a hobby is supposed to be fun and the belief that a sense of personal accomplishment could be achieved without the peer pressures for maximum contacts led to the breakaway, following the 1978 Field Day activities, of five members of the club who subsequently formed "the crew."

When the crew, consisting of Al NØAUS, Pete N6EBC (ex-WDØBJY), Gary WDØGGL, Glen WDØFEO, and Dave WB8KYP, meets, they have only two goals: having fun and planning technical projects which some people say can't be done. It was this attitude that prevailed at the first meeting of the group where plans were formed to construct a floating all-band station. Once the concept was agreed upon, it became obvious that this vessel would require a name befitting its heritage. Since NØAUS had a thing for the *African Queen*, having seen the movie more times than he could remember, it wasn't long before the group came up with some apropos phonetics and a name: CQ, the *Colorado Queen*.

During the winter, plans for a 1979 summer launching were made with reckless abandon and much beer. Chatfield Reservoir, south of Denver, at an elevation of 5432 feet, was chosen as the site of operations and WDØFEO offered the use of his 10-man white-water rubber raft as the ship of destiny. As might be expected, the selection of a suitable antenna and how to mount it to a rubber raft were the biggest problems. The final solution involved a 14AVQ all-band vertical, owned by WDØFEO, and a floating platform. A hollow steel pipe and flange were attached to the center of a large diameter circular section of plywood through which a hole had been drilled in the center. Three 900 x 16 truck inner tubes were mounted under the platform to provide flotation and stability; three outriggers, emanating from the



The crew and the Colorado Queen *preparing to begin the weekend operations.*

WB8KYP readies the triband beam for a little more height.

The backup Kenwood, unloaded by WDØFEO, provided flawless operation.

platform and made from 2 x 4 x 12s, supplied guy points for the vertical which was attached to the pipe. A long cable connected to and extending through the center of the pipe into the water served as system ground. Support framework for the equipment and personal gear was ably constructed through the experience of WDØFEO and the crew's labor.

Now consider, for a moment, a 14-foot rubber raft powered by a 3.5-horsepower motor towing the antenna platform just described with the vertical via a 30-foot rope. While underway, the floating antenna platform maintains its distance, but when the raft is stationary, the weight of the rope and coax connecting the rig on the raft to the antenna tend to draw the platform closer as the cable sinks into the water. A number of four-inch styrofoam balls, with a hole cut through the center for the coax, solved this problem and prepared the *Queen* for her August 18th inaugural voyage.

With a Yaesu FT-101EE powered by two paralleled lead-acid batteries, various 2-meter hand-helds, assorted swr meters, and other gear on board and an appropriate christening with white lightning, the historical launching of the first mile-high freshwater mobile took place amidst the curious gazes of swimmers, boaters, and sunbathers. During the weekend of operation, many contacts were made, lots of time was spent ragchewing as opposed to exchanging callsign, signal strength, contest number and best wishes, and most important of all, a fun time was had by all, including WB8KYP who towed a stranded cabin cruiser back to shore with his "shuttle canoe" and paddle power. The only casualties, other than operator sunburn, on this first voyage were a waterlogged 2-meter hand-held and damp finals in the FT-101EE.

It is a well-known fact that the higher the antenna, the better the communications. Therefore, Green Mountain Reservoir, at an elevation of 8200 feet, was chosen by the crew for the 1980 launching of the *Colorado Queen*. Besides that, WDØFEO offered the use of the family cabin for a weekend of revelry. The same basic raft and antenna platform were used with some extra framing and plywood floor added to the raft for rigidity and the addition of equipment boxes to preclude some of the water problems encountered the previous year.

After a successful launching and an uneventful morning of operation, the crew was languishing on the deck, contemplating the relative merits of Coors beer, better known as Colorado Kool-Aid, when the capricious mountain weather made one of its abrupt changes. In less time than it takes to QRX, the sun disappeared and 70-mile-per-hour winds whipped the surface of the water into a rough pattern of whitecaps. Since the closest land was in the form of an island, the crew cranked up the 3.5 pony-power engine and headed the *Queen* for the leeward side. The

bamboo mast supporting WDØFEO's 2-meter beam split with a resounding crack and the antenna was fished out of the drink by means of the still attached coax.

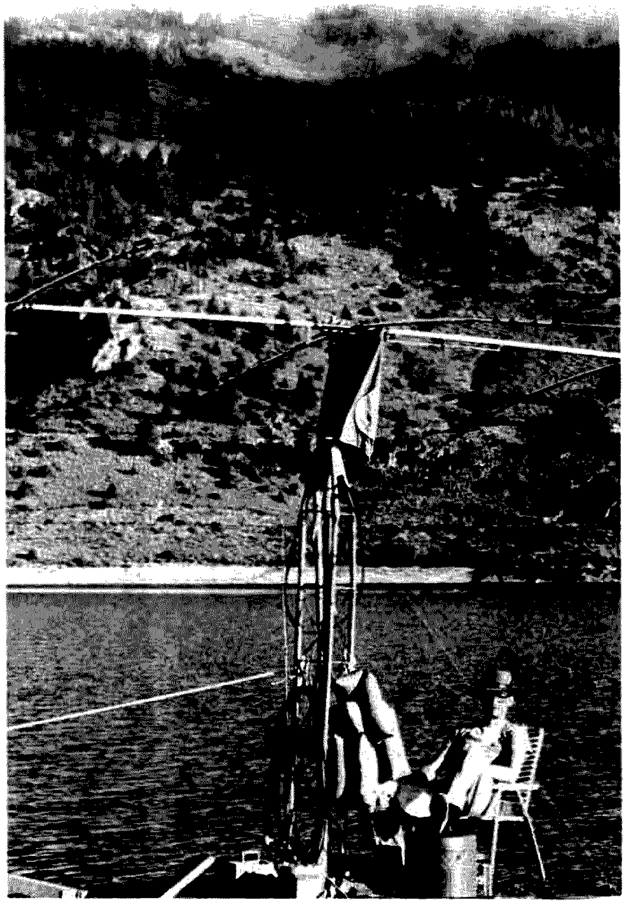
When the island was finally reached, everyone disembarked to attempt to find some shelter. It was a short time later when it was discovered that no one had dropped anchor or tied up the raft, which was now making good time away from the island. Luckily, the shuttle canoe was still on the shore and the chase began. In the ensuing recovery, to add insult to injury, WDØFEO's ten-gallon hat was blown into the water where it promptly sank beneath the waves. Repeated efforts to recover this well-worn relic were all in vain, although WB8KYP swears he saw a catfish wearing something similar as it jumped in front of the raft.

No sooner was the raft secured back at the island than some crew members decided that the original cargo of three cases of beer was fast being depleted and some suntan lotion to soothe the morning's ultraviolet onslaught was in order. What is it they say about discretion being the better part of valor? Anyway, WDØGGL and WB8KYP volunteered to take the canoe and attempt to refurbish the supplies. In an adventure about which the residents along the shoreline still chuckle, these two stalwarts paddled and bailed their way to the far shore, in the only vessel on the water, oblivious to the binocular-equipped audience watching from the many windows on land. Reportedly, the trip back to the island after obtaining the necessary replenishments was much easier with the wind at the rear. Sunday dawned bright and clear, providing a fine atmosphere for the conclusion of that year's freshwater operation with only a Yaesu 2-meter rig sustaining water damage and WB8KYP once again coming to the rescue of a stranded cabin cruiser, but this time he was prepared (?) with a 1.7-horsepower Neptune engine mounted on his shuttle canoe.

By 1981, the crew was looking for bigger and better challenges to conquer with the *Colorado Queen* and had made the operation an annual event taking place the weekend following the July 4th holidays. Commensurate with the arrival of spring, the crew, minus N6EBC who had been transferred to California, gathered to begin construction of the latest version of the *Colorado Queen*.

Over the winter months a new design for the antenna platform had evolved, made necessary by the decision to use WB8KYP's TH-3Jr. triband beam. WDØFEO had managed to find a small boat dock which had four 50-gallon drums attached underneath for flotation and steel-rimmed wheels mounted on the sides for easy water entry and exit. Six 900 x 16 truck inner tubes were added for stability and two 2 x 4s for attaching the floating dock to the framework of the raft. Three holes drilled at the center of the dock allowed the mounting of a steel tower section which was guyed to the four corners of the dock superstructure. The mast was then slipped through the tower pipe and the triband beam mounted on top. Enough mast was used to allow the antenna to be raised between six and fifteen feet and still offer the capability of armstrong rotation.

The first test of this water mobile antenna barge almost drowned two of the crew due to its top-heavy attitude. Subsequently, an exercise with a local firm's Computer Aided Design equipment showed that a 180-pound counterweight suspended nine feet below the water line would stabilize the platform. Oh, the wonders of modern technology. The counterweight was constructed and made adjustable so that it could be raised when approaching the shore or lowered to 14 feet for windy conditions.



WDØGGL relaxes as the sun tries to burn off the early morning mountain mist.

As the weekend of July 11-12 drew closer, construction activity intensified. Boxes to hold the lead-acid batteries were built, a bracket assembly to provide mounting of the 14AVQ to the raft frame for 40- and 80-meter operation was completed, and white paint flowed freely.

By the time launch day 1981 arrived, the crew had put in at least 480 man hours in labor alone. The arrival in Denver of N6EBC a few days prior to the weekend signalled the imminent packup and departure of the crew for the mountains. Assembly of all the miscellaneous parts, all prepared and marked beforehand, took about two hours on Friday.

Meanwhile, N6EBC had brought along some Santa Maria beans from California which he put in a borrowed enamel pot, then adding some "miscellaneous condiments" before placing them on the gas-modified woodstove to cook. I have been known to prepare some pretty bad-looking vittles, but I have never seen anything eat the enamel off the inside of the pot like those beans did. Thank goodness the sirloin roasts with the secret flavoring, barbecued over an open oak fire, were really good.

Bright and early Saturday morning, the rigs and equipment were loaded into the raft and hooked up and the third annual launching of the *Colorado Queen* became history—or so it was

supposed to be. Output power from the Yaesu FT-101B was almost nil and the LEDs on the front of the Icom 2-meter rig would not even glimmer. Power connections were checked and rigs exchanged without success. Finally someone got the bright idea of measuring the voltage of the batteries. Eureka, a brand new heavy-duty battery had a shorted cell and was pulling the parallel battery combination down to about 8.5 volts. The extra drain on the good battery limited current capacity for the day's operation, even after the bad battery was replaced.

Late Saturday afternoon some clouds moved in and the wind picked up, causing a slightly earlier than usual beaching of the *Queen* for the first day. A Kenwood TS-520S was put in service Sunday morning but the skip was not too long, with most of the QSOs originating out of the eighth call area.

From the operating position, N6EBC and N0AUS divide their activities between testing 807s and logging contacts.

Shortly before noon on Sunday, the clouds and wind returned from the opposite direction and the smell of ozone in the atmosphere indicated a high level of static electricity. As WD0FEO guided the floating station into the dock, the static build-up became so bad that a humming and discharge clicking were clearly audible, but the antennas were grounded and the equipment was removed without incident. Despite these technical problems, poor band conditions, high wakes from power boats pulling water skiers (which made the triband elements flap through a three-foot arc), and the many visitors that WB8KYP shuttled back and forth in his canoe, the two days of freshwater mobile operation, gourmet food, and 14 cases of beer made for an unsurpassed weekend of camaraderie and enjoyment.

What will the crew do for an encore? Well, plans are already underway for the construction of a motorized dock large enough for the TH-3Jr. at 30 feet, the 14AVQ vertical, a 2-meter mast and five-eighths groundplane, a gasoline generator, a Model 35 Teletype, three operating positions, and many creature comforts. When not in use, the dock will serve its normal purpose.

If you didn't manage to get your call letters entered into the log of the *Colorado Queen* for 1981, you missed the opportunity of receiving a fine 8 x 10 color picture QSL card. Mark your calendar now for July 10-11, 1982—the crew will be listening for you. ■

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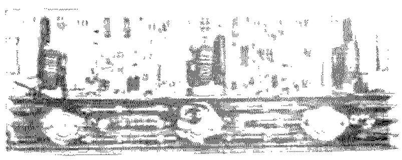

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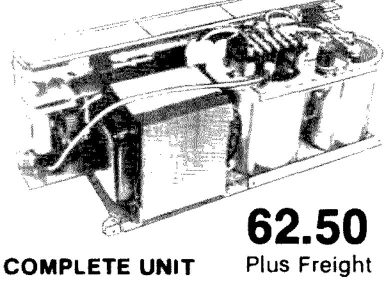

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CB to CW?

—converting the Hy-Gain board

Photos by W1GSL

Operator's view of the transceiver. Note the insulating washers around the key and phone jacks. The internal dc power ground is floated from the cabinet to permit use of an external supply of either polarity. Front panel is 7″ × 4″.

Penn Clower W1BC
459 Lowell Street
Andover MA 01810

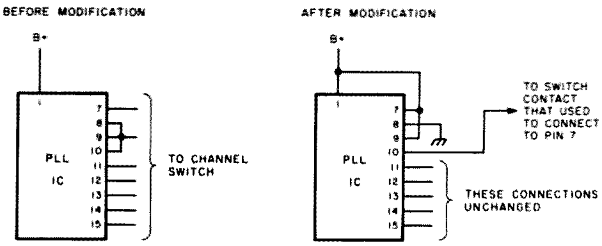


Fig. 1. Channel selector modification.

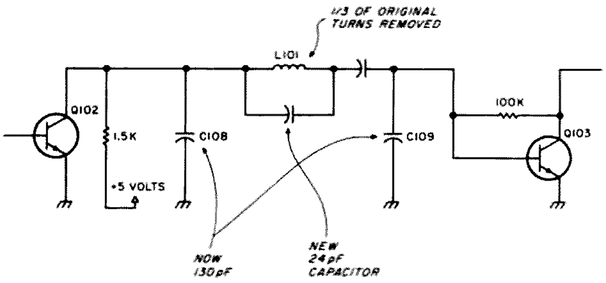


Fig. 2. Modifications to increase bandwidth of low-pass filter.

If you're one of the thousands of hams who bought one of those Hy-Gain CB set printed circuit boards for a song when they appeared on the surplus market, then this may be the article you've been waiting for. Described here is a neat little ten-meter CW rig that boasts a feature you won't get in the standard HF transceiver: full break-in. The rig is built around the Hy-Gain board and is inexpensive to duplicate. You don't have to buy any new crystals or exotic ICs; in fact, the design philosophy has been to add nothing which couldn't be found at the local Radio Shack outlet. If your junk box contains a few old transistor radios and a twelve-volt power source, you shouldn't have to buy anything at all.

Before getting into the actual conversion steps, let's review what we have and where we're taking it. The circuit boards on the surplus market were destined to go into a whole family of Hy-Gain sets (models 2679, 2680, 2681, and 2683, at least). The receiver is a dual-conversion superhet with i-fs at 10.7 and .455 MHz. The transmitter is AM with an output between 3.5 and 6 Watts depending on individual transistor characteristics and the supply voltage. The heart of the frequency-determining scheme is a PLL-02A phase-locked loop chip, and it is possible to put the rig on ten meters by rearranging the wiring of the channel selector switch and modifying some of the other loop components. The theory behind the means of changing the frequency coverage is described in my earlier article ("CB to 10," *73 Magazine*, September, 1980) in more detail than I will go into here. I strongly suggest that you get and study that earlier article along with a circuit diagram of the board (I use the Sams Photofact folder covering the Hy-Gain model 2679A) before you start this project. The modifications aren't difficult, but I won't repeat here large sections of the earlier article. The modifications described here are given in three stages. First, the basic conversion to CW on ten meters: the frequency change, the bfo, fine tuning, and putting the transmitter on CW. Second are some convenience features: sidetone oscillator, detector modifications, rf/i-f gain control, transmitter frequency offset, and an active audio filter. The final stage is the modification to give full break-in. There are a lot of circuit changes involved in the complete conversion and I strongly suggest that you make and try them out one at a time. Troubleshooting a problem can be fairly easy when you know that it must be due to those last five wires you moved. A lot more time and test equipment will be needed if the set is silent and the cause could lurk in any of a half dozen modified areas. There are a lot of circuit changes involved in the complete conversion but most can be made and tested a few at a time.

A complete "road map" of the conversion is shown in Fig. 16 where a block diagram of the transceiver shows how the various steps fit into the big picture. For a starting point, it is assumed that your board is checked out and working as designed on 11 meters.

Several last precautions are in order before getting down to circuit details. Hy-Gain made a lot of these boards in many different varieties. Many have open areas on the circuit board which when filled with components add features like the i-f noise blanker. Don't worry too much about the missing components, but if you are given a choice, take the board with the most parts in it.

There are two different audio amplifier ICs in the sets I have seen: the pin-out and circuit are different, so you should watch out for that. Some boards were made to have the channel switch solder directly to the board, while others had posts for wire leads—this is a minor matter, but something you may have to allow for.

There is one crucial dif-

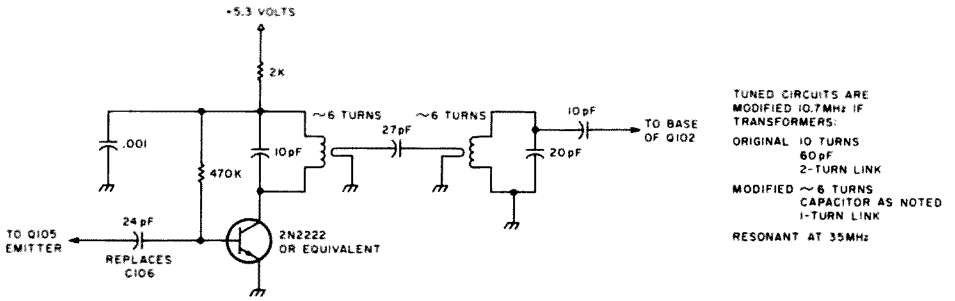
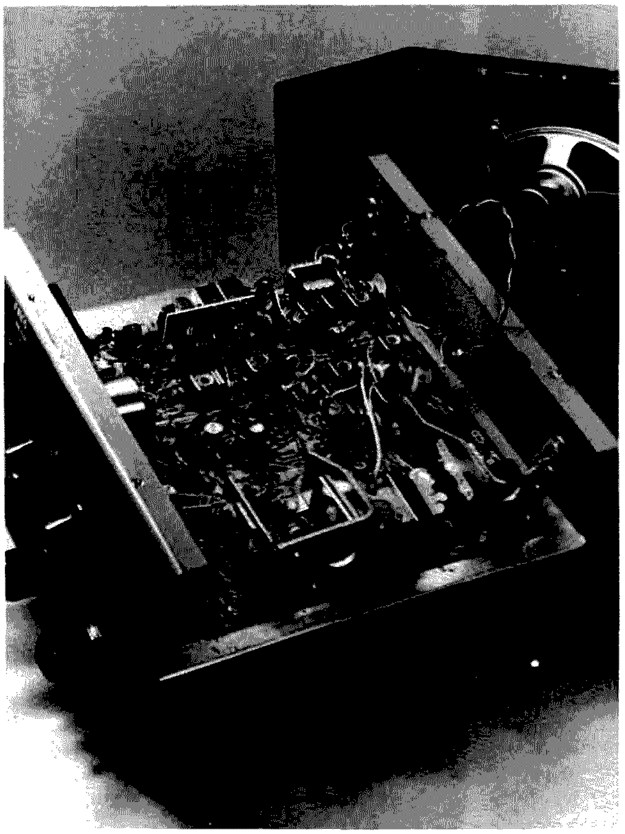


Fig. 3. Tripler schematic diagram.



Interior view. Note the tripler board and the active filter board mounted upright from the main circuit board. Also shown is the method of mounting the speaker inside the top cover.

ference between the boards presently available—the PLL IC sometimes has 16 leads and sometimes has 18. The 16-pin packages may have one of several type numbers, but all are similar to the PLL-02A and can be converted as described in this (and the earlier) article. The 18-pin PLL IC is a dead end. These boards were destined to go in the Hy-Gain 16, a uP-controlled trunk mount model with a fancy calculator-like microphone/control unit. The PC card communicated with that unit via a serial data bus controlled in part by extra circuits inside the 18-pin PLL IC. Those boards cannot be converted as described here. If you have one of those boards, your best bet is to get the microphone and interface card that go with the main board and put it on 10 by changing the 11.806-MHz crystal.

Stage One—The Basic CW Conversion

The first and biggest step in modifying the rig is getting the operating frequency to ten meters. The conversion of the phase-locked loop requires three main steps: changing the programming of the loop divider, increasing the passband of the low-pass filter following the loop mixer, and adding a frequency tripler between the 11.806-MHz crystal oscillator and the loop mixer. Changing the loop frequency programming is the easiest step of the three. The PLL-02A chip contains a nine-stage binary divider which, along with the 10-kHz reference derived from the 10.240-MHz oscillator, sets the loop operating frequency. The divider is switched by changing the dc levels on pins 7 through 15. A logic one (5 volts) on a particular pin will enable the division controlled by that pin. All nine control pins are manipulated by the channel switch so that for channel 1 the overall division is 224 while on channel 40 the division is 268. The plan is to change this switch coding and therefore the operating frequency.

For example, note that since channel 1 is on 26.965 MHz and the steps are 10 kHz apart, we could move channel 1 to 28.005 MHz if we could change the divisor code to correspond to 328 on that channel instead of 224. Unfortunately, we can't make completely arbitrary changes in the divisor size because we are stuck with the channel switch and the code built into it. However, it is possible to reroute the connections between the switch and the PLL chip so that channel 1 moves up 960 kHz to 27.925 MHz. This means that channel 8 will then fall on 28.015 MHz and channel 40 on 28.365 MHz. The bulk of ten-meter CW activity takes place in the lower 200 kHz of the band, so the seven lower channels won't really be missed.

Now for the actual wiring changes. The schematic of the change is shown in Fig. 1. First cut apart pins 8, 9, and 10 of the IC on the circuit board foil. Pin 7 is disconnected from the channel switch and connected to +5 volts at pin 1, and the same is done for pin 9. Pin 8 is grounded and pin 10 is connected to the switch terminal that used to go to pin 7. That's all there is to the channel selector modification.

The frequencies for the new channels are given in Table 1 along with the appropriate phase-locked loop coding. The logic 1 level corresponds to 5 volts, while the 0 is ground, and you will want to run down the IC pins with a voltmeter to verify that the correct code for a particular channel actually shows up. There are several types of 40-channel switches sold for use with this board and it is easy to get confused about where the 5 volts goes in and the various IC pin connections come out.

Notice that the 10-meter channels, like the CB channels, are 10 kHz apart but that some frequencies are skipped and others are out of order. Be careful of the

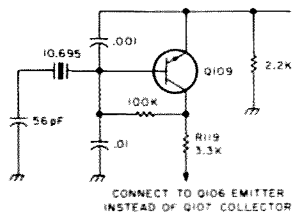


Fig. 4. The bfo, Q109, is supplied power constantly from Q106 instead of only during transmit.

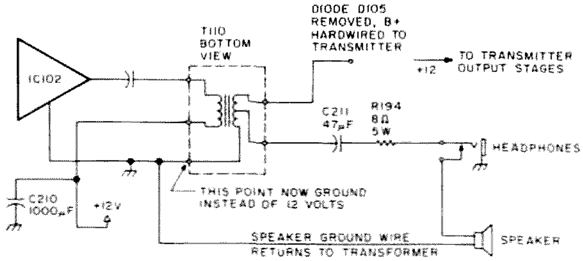


Fig. 5. Changes to audio output stage. The modulator is disabled by the removal of D105 and the speaker circuit is now operated at ground potential.

band edges, particularly if you're a Novice and especially after the fine-tuning modification is added.

The next step is to change the passband of the low-pass filter between the loop mixer, Q102, and the mixer buffer, Q103. This modification is necessary because the highest frequency passing through this filter is now 3.64 MHz instead of 2.68 MHz. The circuit changes, shown in Fig. 2 are straightforward. C108 and C109 are reduced from 330 to 130 pF, about one-third of the turns are removed from L101, and the inductor is paralleled by a 24-pF capacitor. These changes are fairly non-critical; the set described in the earlier article used 180-pF capacitors, half the turns on L101, and 82 pF in parallel with the coil. The values shown in Fig. 2 work fine, but if you have some capacitors that are slightly larger, don't be afraid to try them.

The final and probably most complex change is the addition of the tripler following the 11.806-MHz oscillator. The mixer input is really looking for the third harmonic of that frequency, but the Hy-Gain designers were able to save a stage by letting the mixer do the frequency multiplication as well as the mixing function. That trick doesn't work as well for us because the loop operating frequencies are shifted enough that some of the spurious mixer products cause trouble. As explained in the previous article, these spurious products can actually prevent lock on frequencies higher in the ten-meter band. The CW end of the band is close enough to the CB frequencies that the loop will lock without the tripler addition, but I found that the fine-tuning modification (described later) would not function properly. The frequency would shift all right, but over a portion of the shift range an unwanted beat note would appear in the mixer output. This beat would cause FM on both the transmitted and received signals. The tripler completely cured the problem, but you may elect to first get the loop running without that added complication as an easy means of verifying the other PLL modifications. By all means do add the tripler before getting on the air, or be prepared to get a lot of reports of hum on your signal (and don't be fooled, as I was at first, by looking at your output envelope and seeing no modulation—it sounds like AM hum, but being FM won't show on a scope.

The tripler schematic shown in Fig. 3 is simpler than the one described in the first article, but works just as well. A single stage multiplies the 11.806-MHz signal and two lightly coupled tuned circuits select out the 35.4-MHz signal. The tuned circuits used in this version are 10.7-MHz i-f transformers modified by the removal of half the turns on the core and replacement of the 55-pF stock capacitors with 20-pF units. Some experimentation may be necessary to get the circuits resonant at 35 MHz, and a good grid-dip meter is an invaluable aid. There are other techniques which would work well. For example, if you're really well equipped, you could use a variable frequency signal source and a high bandwidth oscilloscope. Of course, you can use any other type of tuned circuit—whatever the junk box has as long as it fits into the space available.

As shown in the photographs, I built the circuit on a small scrap of printed circuit board and supported it by the stiff leads used to supply power and signals to the board. This isn't the most mechanically rugged technique, but it is neat and with careful placement of the support leads is strong enough to be reliable. I reinforced the wires where they entered the main circuit board with a small drop of epoxy cement so that the stress would not be on the thin circuit foil below the board.

Once these circuit modifications are made, the loop can be adjusted for proper operation. Monitor the dc voltage on the positive side of C115 and adjust the vco slug (T101) so that the voltage varies from a low of around a volt on channel 1 to a high of about two volts on channel 40. The voltage should change slightly each time the channel switch is advanced. This voltage is a measure of the driving force necessary to pull the vco from its free-running frequency (set by T101) to the frequency requested by the channel selector; in fact, a meter inserted at this point could be calibrated to

		PLL Pin Levels								
Channel	Frequency	15	14	13	12	11	10	9	8	7
1	27.925	0	0	0	0	0	0	1	0	1
2	27.935	1	0	0	0	0	0	1	0	1
3	27.945	0	1	0	0	0	0	1	0	1
4	27.965	0	0	1	0	0	0	1	0	1
5	27.975	1	0	1	0	0	0	1	0	1
6	27.985	0	1	1	0	0	0	1	0	1
7	27.995	1	1	1	0	0	0	1	0	1
The above channels not in the 10-meter amateur band.										
8	28.015	1	0	0	1	0	0	1	0	1
9	28.025	0	1	0	1	0	0	1	0	1
10	28.035	1	1	0	1	0	0	1	0	1
11	28.045	0	0	1	1	0	0	1	0	1
12	28.065	0	1	1	1	0	0	1	0	1
13	28.075	1	1	1	1	0	0	1	0	1
14	28.085	0	0	0	0	1	0	1	0	1
15	28.095	1	0	0	0	1	0	1	0	1
16	28.115*	1	1	0	0	1	0	1	0	1
17	28.125*	0	0	1	0	1	0	1	0	1
18	28.135*	1	0	1	0	1	0	1	0	1
19	28.145*	0	1	1	0	1	0	1	0	1
20	28.165*	0	0	0	1	1	0	1	0	1
21	28.175*	1	0	0	1	1	0	1	0	1
22	28.185*	0	1	0	1	1	0	1	0	1
23	28.215	1	0	1	1	1	0	1	0	1
24	28.195*	1	1	0	1	1	0	1	0	1
25	28.205	0	0	1	1	1	0	1	0	1
26	28.225	0	1	1	1	1	0	1	0	1
27	28.235	1	1	1	1	1	0	1	0	1
28	28.245	0	0	0	0	0	1	1	0	1
29	28.255	1	0	0	0	0	1	1	0	1
30	28.265	0	1	0	0	0	1	1	0	1
31	28.275	1	1	0	0	0	1	1	0	1
32	28.285	0	0	1	0	0	1	1	0	1
33	28.295	1	0	1	0	0	1	1	0	1
34	28.305	0	1	1	0	0	1	1	0	1
35	28.315	1	1	1	0	0	1	1	0	1
36	28.325	0	0	0	1	0	1	1	0	1
37	28.335	1	0	0	1	0	1	1	0	1
38	28.345	0	1	0	1	0	1	1	0	1
39	28.355	1	1	0	1	0	1	1	0	1
40	28.365	0	0	1	1	0	1	1	0	1

*These frequencies are in the Novice segment.

All frequencies given are nominal and may vary ±5 kHz or so if you include the fine-tuning modification.

Table 1. New channel frequencies and PLL coding.

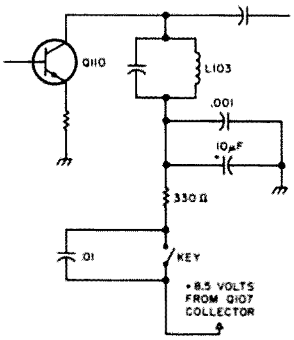


Fig. 6. Circuit modification to allow transmitter keying at the transmitter mixer, Q110.

read the ten-meter operating frequency.

Knowing this, you can easily determine if the phase-locked loop is running normally. If, for example, you can switch channels without changing the voltage at C115, then the vco frequency hasn't moved as it should and something is wrong. If the voltage seems to hop around in great leaps as you rotate the channel selector, then the channel switch is probably wired up to the PLL incorrectly.

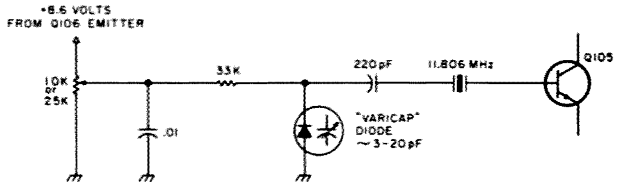


Fig. 7. Fine tuning with a varicap diode.

Another good means of testing for proper operation is to listen to the output of the loop mixer with a receiver. Remember that on channel 1 the loop divider is set to 320 and that on channel 40 it is set to 364. That means that the output of the mixer buffer, Q103, will be at 3.200 MHz on channel 1 and 3.640 MHz on channel 40. Accordingly, when the channel is set to 36, the output of Q103 should be on 3.600 MHz, and that can be easily verified by connecting one end of a length of wire to the antenna terminal of an 80-meter receiver and wrapping the other end (insulated, with no direct electrical connection) around Q103. You can figure out which channel position corresponds to 36 by counting backwards from channel 40; that channel you can find by watching for the large voltage change across C115 as the loop jumps from channel 40 to channel 1.

As an aside, it's interesting to note that the rig can now be used as a crystal-controlled calibrator which can be walked in precise 10-kHz steps across the bottom portion of 80 meters. The 3.600-MHz output on channel 36 can be zero beat with your crystal calibrator by adjusting the 10.240-MHz oscillator; then the PLL signals will be just as accurate on any of its channels as your calibrator is at 3.6 MHz.

With the PLL modifications complete and operating, the set should operate as an AM rig (into a dummy only!) from 27.925 to 28.365 MHz. By peaking up the receiver front end (T104 and T105) and connecting an antenna, you should be able to hear some CW signals, though without a bfo you won't be able to copy them. The transmitter can be peaked into a dummy load by adjusting L103, L102, T102, T103, L106, L109, and L110. You'll find that the first three adjustments mentioned are the sharpest tuning ones. I would suggest peaking everything up on 28.115 MHz (channel 16) since most of your operation will be within 100 kHz of that frequency.

The remaining steps in the basic CW conversion are the bfo addition, the AM to CW transmitter change, and the provision for fine tuning. These steps were covered in detail in the first article so will only be mentioned briefly here. The bfo is actually the 10.695-MHz transmit carrier oscillator, Q109, which can be turned on during receive by connecting the supply end of the 3.3k emitter resistor (R119) so that it gets 8.5 volts all the time in-

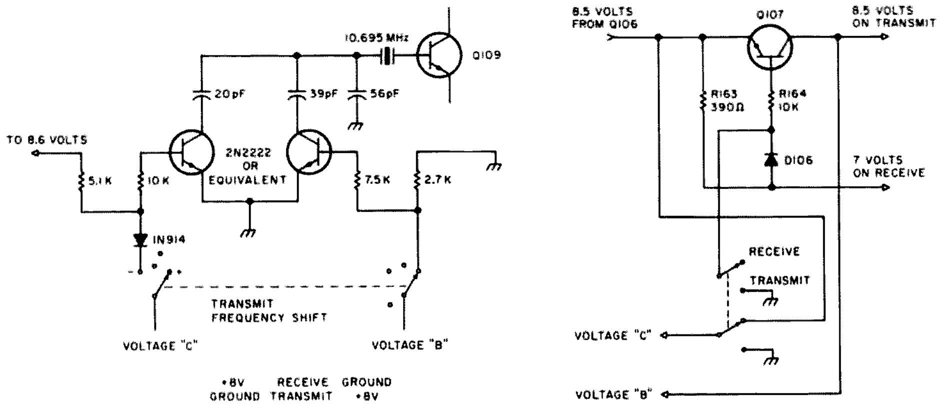


Fig. 8. (a) Circuit to provide a selectable frequency offset during transmit. (b) Circuit for manual T/R switching.

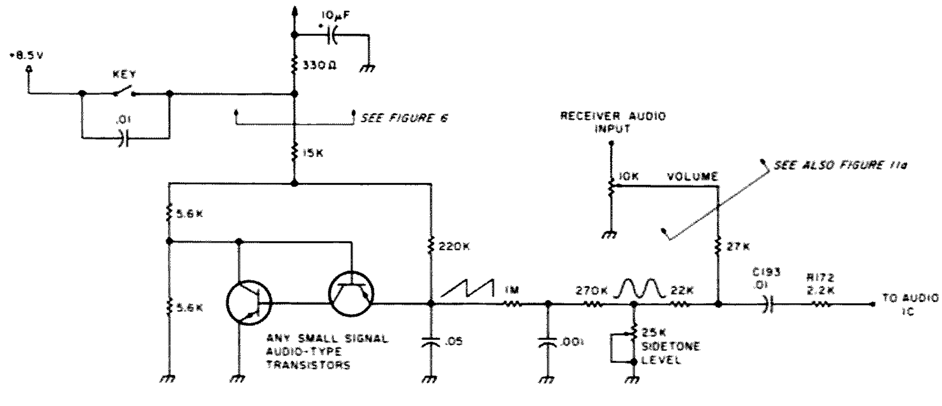


Fig. 9. Sidetone oscillator circuit.

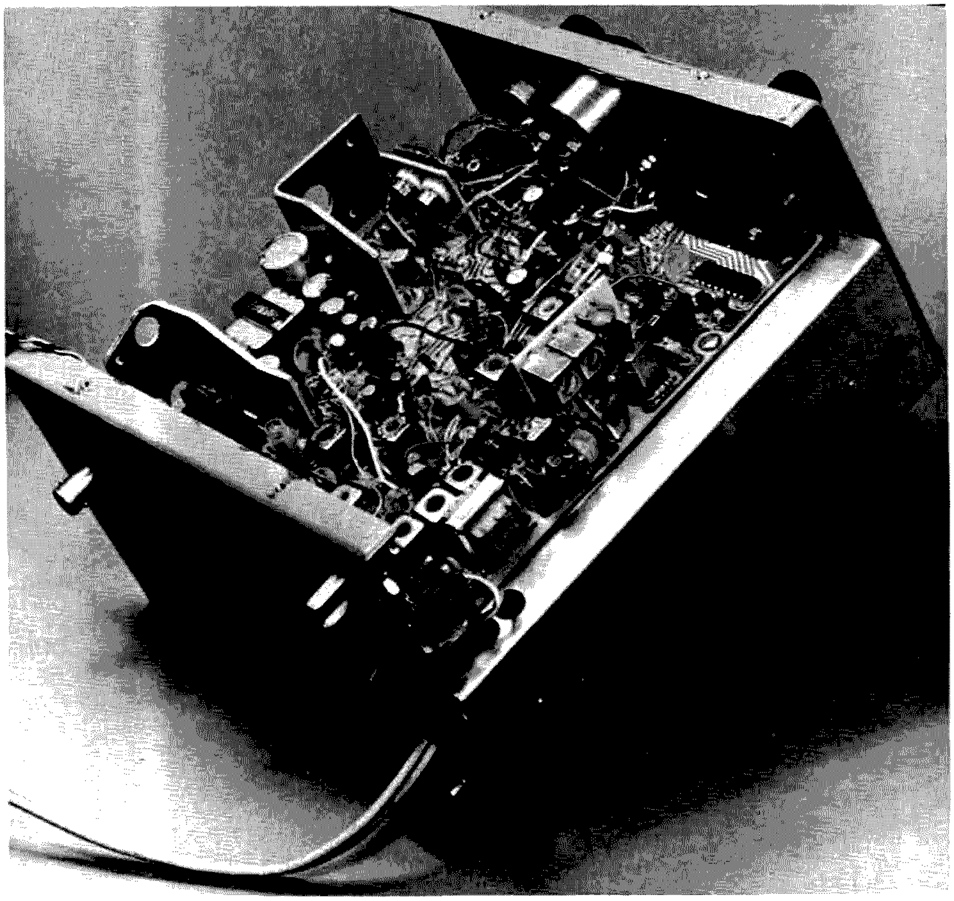
stead of only when the rig is transmitting. The emitter of Q106 (the 8.5-volt voltage regulator) is a convenient source for this voltage. The circuit change is shown in Fig. 4.

Putting the transmitter on CW is almost as simple. First the modulator output is disconnected from the transmitter driver and final amplifier by the removal of diode D105 (located just behind the audio transformer). The transmitter stages are then powered by wiring the 12-volt line directly to what used to be the cathode end of the diode. The final and driver are class C amplifiers so they won't draw any current until driven and there is no need to switch this power line. It is prudent to keep a load on the audio power stage at all times, but at this point there is no load during transmit because the modulator function is disconnected. The microphone push-to-talk switch normally opens the speaker circuit during transmit and that should be rewired so that the lower end of the speaker is connected to ground at all times. The output transformer is also rewired so that the speaker circuit does not operate with a 12-volt bias. This step helps reduce speaker thumps caused by the 12-volt supply dropping when the transmitter is keyed. These modifications to the transmitter are shown in Fig. 5.

Finally, some provision must be made for keying the transmitter, and that is done by keying the B+ line feeding the transmit mixer as shown in Fig. 6. The RC filter added in series with the power lead softens the rise and fall times enough to give brisk but clickless keying.

The fine-tuning modification is shown in Fig. 7. The 11.806-MHz heterodyne oscillator is tuned over about a 4-kHz range with a varicap diode, thus giving after frequency multiplication a 12-kHz shift in operating frequency. If your junk box doesn't have any varicap diodes, you could substitute a 35-to-55-pF trimmer capacitor, but the diode is a neater method. Not all tuning diodes are the same and you may have to try several or put several in parallel in order to get the required frequency change. Notice that as the oscillator is moved around in frequency, the phase-locked loop will force the vco to move in step so that the output signal of the loop mixer (Q103) will not change in frequency.

At this stage of development the rig is ready to go on the air. Keep in mind that the zero-beat frequency is the transmit frequency and people will have a tendency to move in that direction. Once you realize that is happening, you can ask the other fellow to stay a kHz offset from your transmitting frequency, or you can simply move the fine-tuning knob a bit when you start to receive. That's a nuisance, but not really a big problem when you get used to it.

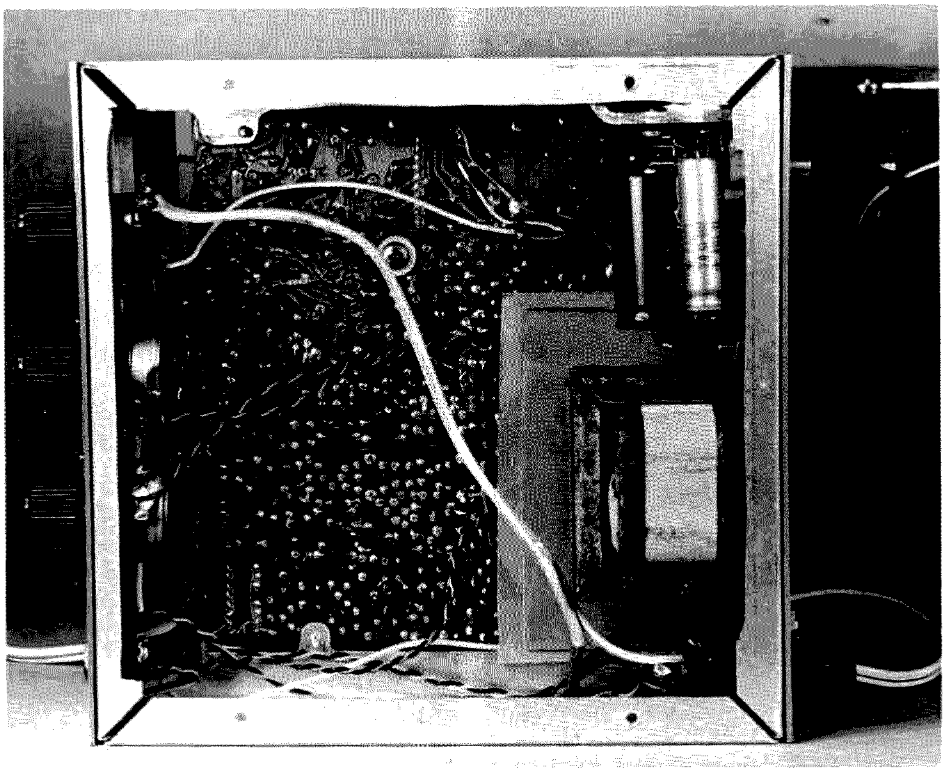


Back inside view. Note rear panel BNC for rf, miniature jack for external speaker DPST switch and male jack for external dc supply, and ac fuse for internal supply.

Stage Two—Some Convenience Features

There are a lot of features which can be added to the basic transceiver to increase operating convenience. The most appreciated will probably be a means of automatically offsetting the transmitter's frequency from the receiver's and the sidetone oscillator. The receiver performance can be increased considerably by removing the agc circuitry, which is now responding to the bfo instead of the other station anyway, and controlling the rf and i-f gains from a front-panel potentiometer. There are some changes which can be made to increase the sensitivity of the detector—mainly the removal of the noise limiter. Last but not least is the addition of an active audio filter to give the receiver some much needed selectivity.

The way to offset the carrier oscillator is shown in Fig. 8. If you examine the printed circuit foil closely, you'll find that this same technique was destined to be used on the 10.24-MHz oscillator as a receiver offset option. Somehow it seems more natural to move the transmitted frequency without affecting the receiver. Depending on the characteristics of in-



Bottom view. Power supply module in place. Rectangular object behind the transformer is the magnetic shield described in the text. Power supply connecting wires are left long enough to allow the module to be moved for circuit board servicing. Note that the cut-out portion of the chassis top allows for dc isolation of the PC board ground.

dividual crystals, there may be some changes required in the sizes of the 56, 39, and 20-pF capacitors. Those values with my crystal gave a ±700-Hz offset. The circuit shown is designed to be mated with voltages available from the break-in sequencing circuits described later. If you are going to use a mechanical switch for the transmit-receive changeover, then the circuit of Fig. 8(b) is an easy means of getting the two controlling voltages.

The circuit for the sidetone oscillator is shown in Fig. 9. There is nothing special about this circuit, but it does use few parts and draws only about .3 mA of current. The tone can be adjusted by changing the size of the 220k resistor if desired. The oscillator generates a sawtooth which is a bit harsh-sounding, so a low-pass filter comprised of a 1 meg resistor, the .001-uF capacitor, and the 270k resistor is used to smooth out the waveform. There is nothing critical about any of these components or the transistors used and value changes of as much as 30% will probably go unnoticed.

Several changes were made to the detector circuitry to make it more suitable for CW use. The "before" and "after" schematics are shown in Fig. 10. Two changes are clearly needed: The S-meter and agc are removed because they now respond to the bfo signal instead of incoming Morse signals. This was particularly troublesome since the agc insisted on keeping the receiver gain low, and so the first change is to control the agc line with a front-panel 25k pot. (I had hoped that this control wouldn't be necessary and that the receiver could be set for maximum gain, but it turns out that strong signals on nearby frequencies, i.e., local CBers and worse, can cross-modulate the front end and show up in the audio output. This is probably due to using the 10.695-MHz bfo as much as poor front-end design. In the future, I want to try adding a proper 455-kHz bfo, but for now I can significantly reduce the problem by using the i-f gain control and switching when necessary to a horizontal dipole. Most CB operation is with vertical antennas, so the local operators are attenuated by 3 or 4 S-units when a horizontal antenna is used.)

Also removed from the detector circuit is the noise

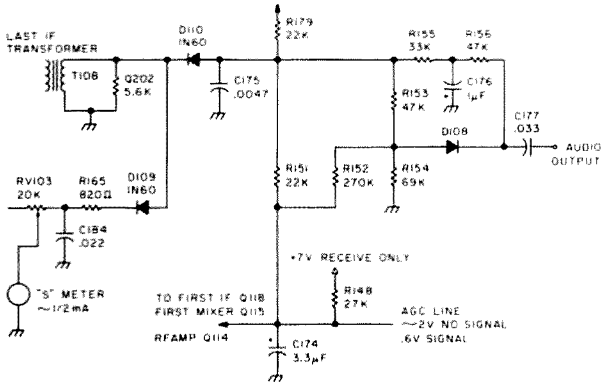


Fig. 10(a). Detector circuit before modification.

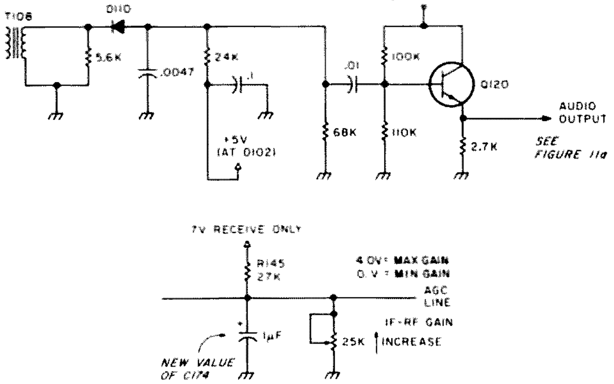


Fig. 10(b). Detector circuit after modification.

limiter consisting of R155, R156, C176, and D108. These components are in a rather clever arrangement which clips both low-level fuzz and high-level spikes. Interestingly, the circuit on the board is always wired up and operating and it was only the models which had the provision for turning the circuit off (by putting a switch in place of the jumper J106) that advertised the feature!

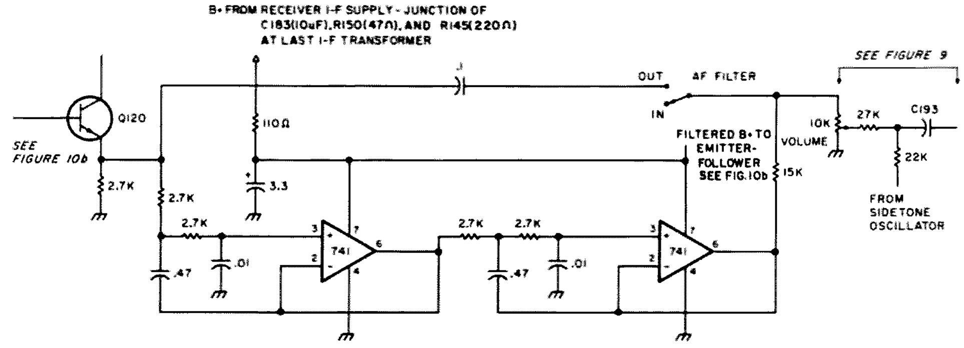


Fig. 11(a). Circuit diagram for active filter.

The squelch is also removed, but the squelch transistor, Q120, is rewired as an emitter-follower buffering the audio output signal. There are two reasons for this addition. It was found in the breadboard stage that the original volume control setup, a 50k pot from C177 to ground, was susceptible to picking up hum as I probed around the circuit board with a finger. The use of an emitter-follower makes it possible to have all of the wires leaving the board be low-impedance lines, while at the same time the high-impedance portions of the circuit are kept physically small, which means that hum is much less of a problem. The emitter-follower is also a good interface between the detector and the active audio filter. As can be seen in Figs. 11(a) and 10(b), the same B+ decoupling circuit is used to power the active filter and emitter-follower. There is a lot of audio gain after these circuits and a well-filtered voltage source is a must to prevent audio oscillations.

The audio filter design is straight from *Solid State Design for the Radio Amateur* (an ARRL publication). A peaked low-pass characteristic was chosen because of its high attenuation above the cutoff frequency. Two sections are used, each with a Q near 5 and a cutoff frequency of about 800 Hz; the overall frequency response is shown in Fig. 11(b). The two op amps are operated between ground and the 12-volt supply, with the input signal being biased at 6 volts by the emitter-follower. This arrangement saves the several resistors which would otherwise be necessary to derive the bias voltage. The output of the filter is fed to the volume control through a 15k resistor, thus providing some attenuation to compensate for the peaking above unity gain which occurs at the cutoff frequency.

The 15k value was chosen so that the speaker level of an 800-Hz tone is approximately the same either with or without the filter being used. The resistor also serves the purpose of providing a high-output impedance for the filter—when the filter is switched "out," what actually happens is that the low-impedance output of the emitter-follower attenuates the filter output into insignificance. The audio from the volume control is fed into the IC audio amplifier as indicated in Figs. 9 and 11. The filter is quite a help when the band gets crowded, often making otherwise impossible contacts easy copy. With the filter switched out, it is easy to quickly scan the band using only the channel switch since even signals several kHz from bfo zero beat can then be copied.

The rf voltmeter shown in the photographs was introduced simply by inserting parts into the proper holes on the circuit board. This was another feature not wired until the last stages of manufacture. The only departure I made from the Hy-Gain layout is the replacement of the variable resistor (Rv104) on the circuit board) with a fixed 15k unit. That gives about half scale on my meter, a .5-mA unit, with five Watts of output. You can change this as necessary to fit the meter you choose. The circuit, shown in Fig. 12, has a 10-uF capacitor to filter the rectified waveshape so that the pointer won't slam back and forth with keying.

Stage Three—Full Break-in

Full break-in CW operation is something that few newer hams have experienced, principally because many amateur transceivers are designed with sideband in mind and CW added as a "tack-on." With full break-in it is possible to hear the other fellow sending whenever your key is up, even in the middle of a letter. When the stations at both ends of a QSO have break-in capability, the conversation is

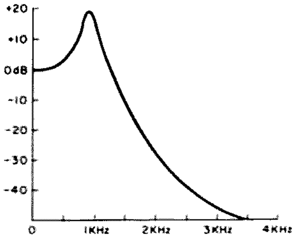


Fig. 11(b). Measured performance of filter.

very much more natural than the usual segmented contact. Break-in is also a good operating feature: It's much easier to make and continue QSOs under difficult conditions when you can hear what's going on during your transmission.

The big problem with getting a transceiver to operate full break-in successfully is the elimination of clicks and thumps in the receiver as the rig is switched rapidly between transmitting and receiving. Many things must occur in an ordered sequence as the rig is keyed. When the key is closed, the receiver must be biased off—the rf amplifier must be disabled, the agc turned down, perhaps an i-f stage muted as well. Any frequency offset in the vfo must be done before the

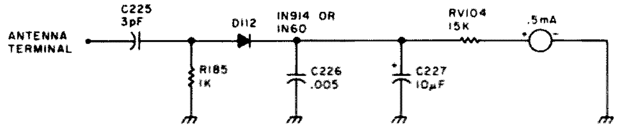
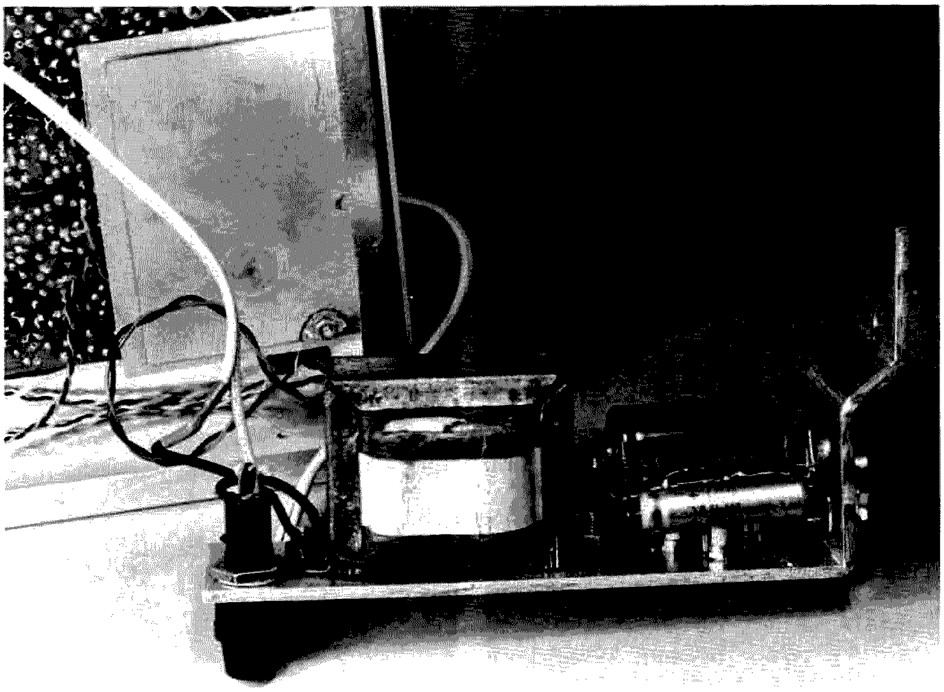


Fig. 12. Rf voltmeter added by putting parts into the appropriate positions on the PC board.



The power supply module removed from the main chassis to show construction. The aluminum bracket is 1/8" thick and transfers the power dissipated from the IC regulator into the main chassis.

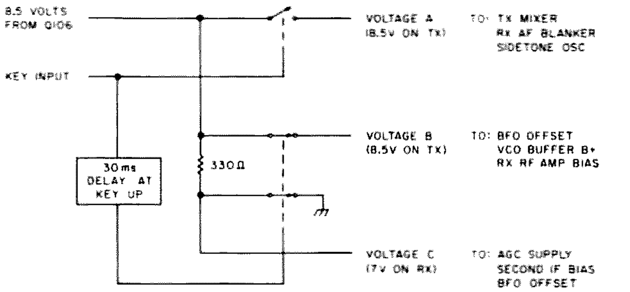


Fig. 13(a). Block diagram of break-in timing system shown in receive mode. Note that voltage C is inverse of voltage B.

transmitter comes on, and some sidetone must be inserted into the audio amplifier. The rf envelope must come up smoothly to avoid over-the-air clicks. When the key is raised, nothing should happen until the rf output has smoothly died away; then the vfo shift must be reinstituted and the receiver reactivated. Most importantly, all of these big shifts in operating condition should occur rapidly, yet without causing undue disturbances in the output audio. Ideally, the operator listening to the receiver would hear his own keying just as if it were coming from another station over the air. A very good break-in system is difficult to come by, and the circuits worked out for this application, while not providing perfect break-in, certainly provide acceptable performance.

The heart of the break-in circuitry, shown in Fig. 13, requires the addition of three transistors labeled Q1, Q2, and Q3. When the key is closed (keying current is 7 mA, which should be compatible with any keyer), Q107 is turned on directly and its output turns on the transmitter and turns off the receiver audio with a circuit which will be described shortly. The grounded keying terminal also provides a rapid discharge path for the 4.7-uF capacitor. Notice that while this capacitor can discharge through the signal diode, it must recharge more slowly through a 10k resistor. That inequality will provide a 30-ms recovery delay to keep the receiver off until the transmitter output has decayed completely away. The voltage across the 4.7-uF capacitor drives the base of Q1, and the emitter of that transistor is biased at about 2.4 volts by a forward-biased diode and an LED (which serves double duty as a front-panel power indicator). As the voltage at the base of Q1 rises and falls past 3 volts or so, the transistor turns on and off, switching in turn Q2 and Q3. The timing waveforms are shown in Fig. 13(c), with the exception of voltage B, which does pretty much the opposite of voltage C. The important fact to note is that while all three of these controlling voltages switch

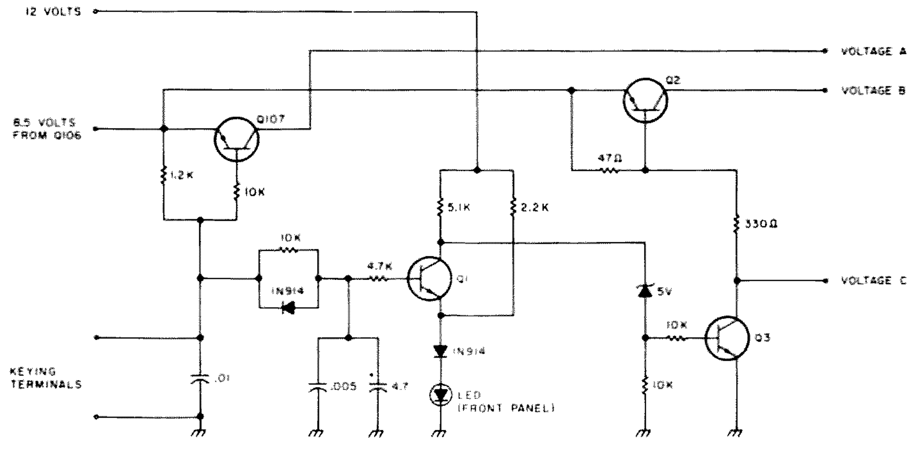


Fig. 13(b). Schematic diagram of break-in timing system. The transistors are general-purpose low power types.

simultaneously at key-down, only the collector voltage of Q107 switches immediately at key-up. As shown in Fig. 13(c), the 30-ms delay gives plenty of time for the transmitter to get off the air before the receiver is turned back on. Also indicated in Fig. 13(b) and Fig. 16 is where the three controlling voltages go in the rig as a whole.

The sequencing circuits just described give plenty of receiver protection during keying, but unfortunately they are not thumpless. Some additional quieting was achieved with the addition of the simple audio blanker shown in Fig. 14. I've used this system for several months and find its performance quite acceptable. Being a bit of a perfectionist, however, I have looked into the reasons for the remaining thumps. The complete cure would seem to require a soft exponential transition of perhaps 10-ms time constant on all of the keying waveforms controlling the receiver. The rf amplifier bias, second i-f bias, and agc line inputs are relatively easy to filter by the addition of the proper capacitors, but vco buffer B+ must be powered from a low-impedance source during transmit and so would require either the addition of another transistor or a change in the timing circuits to ensure that the receiver is off when buffer B+ is stepped up or down. Turning the receiver off exponentially may require a different sequencing circuit in any case to delay the transmitter turn-on. The system described in Fig. 13 works fine, but if you enjoy experimenting, you might look into some variations.

One last hint on reducing keying noise: Be sure to return the speaker ground wire to the circuit board as closely as possible to the ground pin of the audio IC. This will be pin 2 if the IC is a BA521 or pin 9 if it is a TA7205. Otherwise, the heavy transmitter keying current (around 1 Amp) can couple into the speaker wiring and cause a click that is not muted by the receiver gain control.

Odds and Ends—Power Supply, Cabinet, Future Work

All in all, this makes a very nice little CW rig. The only reason it might be classified as a toy is that it is so inexpensive to get on the air. If your junk box contained several old transistor radios, the total cash outlay for the project to this point should be something less than $20. I built the rig to this level and used it for about a month before deciding on a cabinet. The construction for the final enclosure is pretty well explained by the photographs. The board was mounted into the top surface of a 7″ × 7″ × 2″ chassis, front, back, and bottom plates were added, and a U-shaped cover was fabricated to form the top and sides. A 2½″ × 4″ oval speaker rescued from a junk TV set was mounted behind a grid of holes drilled in the top of the U. The holes were drilled using a piece of scrap perfboard as a guide—that made it easy to get such a nice even array. A piece of thin black cloth contact-cemented over the holes from the rear (after painting the box) protects the speaker from dust and dirt. The U-shaped piece happens to be a section cut from a large steel chassis bottom plate so I was able to solder nuts to the underside as anchors for the speaker mounting clamps.

It is certainly a convenience to have a built-in ac-operated power supply, and with any number of excellent IC regulators available for a couple of dollars, it seemed a shame to tie up a bench supply. The power supply shown in the photographs was built around a transformer and regulator found in my junk box. The circuit suggested in Fig. 15 will fit in the same space and shouldn't cost more than $15 if you buy all new parts.

As can be seen in the photographs, the power supply is built as a separate module. The aluminium bracket is fashioned from part of an old 1/8″ thick rack panel and fits up against the insides of the main chassis which then serves as a heat sink. To provide for portable opera-

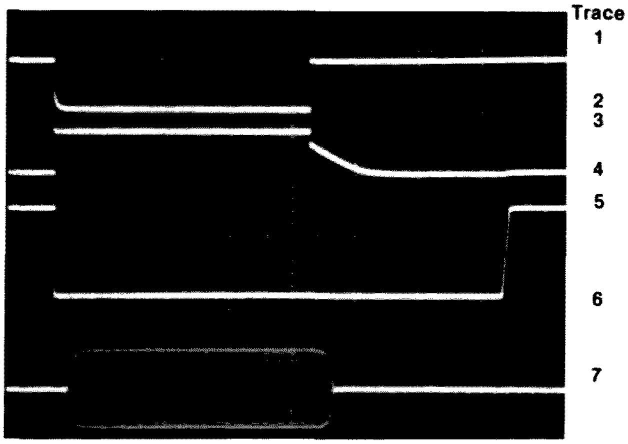


Fig. 13(c). Timing waveforms. Horizontal scale is 10 ms per division; character shown is one dot at 30-wpm rate. Trace 1 is key-up position; 2 is key down; 3 is +8 volts and 4 is ground (voltage A, Q107 collector); 5 is +8 volts and 6 is ground (voltage C, Q3 collector); 7 is rf envelope output, 50 volts/div., 62-Ohm dummy load.

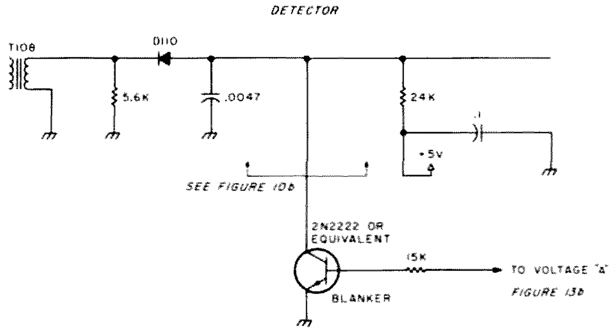


Fig. 14. Audio blanker circuit.

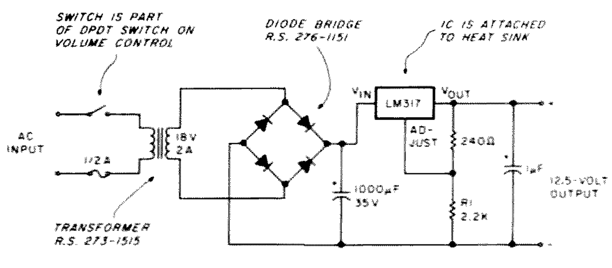
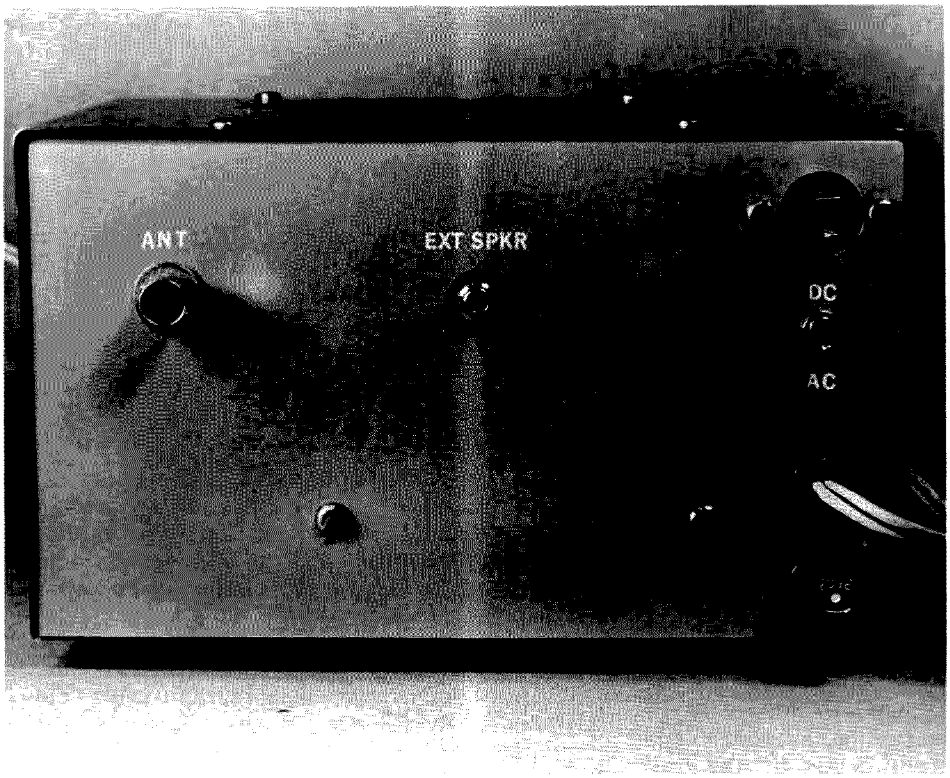


Fig. 15. Suggested circuit for ac-operated power supply. Output voltage should be no lower than 12 to 12.5 volts at 1.5 Amps of load current. Output voltage may be adjusted by making small changes in R1.



The rear panel. The antenna shield is ac coupled to the circuit board ground. Note the isolating washer around the external speaker jack.

tion with an external 12-volt battery, a DPDT switch and male jack are mounted on the rear of the set to select the desired power source. Note in Fig. 16 that the power switch on the back of the volume control is also a DPDT unit and that this allows switching of both the ac and dc power lines so that the switch will work with either internal or external supplies.

What is not clear in the photographs or schematics is that the entire enclosure is isolated by capacitors from the circuit board's dc ground. This feature could prevent some fireworks if you used the rig in a car with a positive ground electrical system! The dc isolation is provided for on the board by separate foil mounting pads, but you have to be careful to use isolating washers when mounting the key and headphone jacks.

While on the subject of power supplies, a word or two about dc supply voltage is in order. The transmitter rf output will vary from set to set because of transistor differences, but it will always go up with increased supply voltage. With my transmitter, 11 volts gives 3 Watts, 12 volts gives 4 Watts, 14 volts gives 5 Watts, and 15 volts gives 5.5 Watts of transmitter output. My power supply is set to deliver 12.7 volts on receive and this falls to 12 volts on transmit because of the 1.5-Amp current drain. Going to a 15-volt supply would provide an extra Watt and a half of output, but that is only 1.4 dB or less than ¼ of an S-unit worth of signal gain. You will notice in the photographs that the output transistor's heat sink is not attached to the cabinet wall as intended for the CB application. With a 12-volt supply, the final stage input is about 11 Watts, and with 4 Watts of output power, that leaves 7 Watts of heat to be dissipated by the heat sink. After a long transmission, the heat sink gets warm to the touch though not uncomfortably so. Higher input power would probably require that some attention be paid to this heat sink as well as the power supply. All in all, it doesn't seem worth the trouble for less than ¼ of an S-unit.

Whenever a power transformer is mounted in close proximity to sensitive circuits, the possibility exists of magnetically coupling 60-Hz hum into the signal path. For this reason, the transformer was mounted as far as possible from the audio section of the printed circuit board. Despite this precaution, there was a noticeable amount of hum modulating the received signals whenever the internal supply was used. This problem was completely cured by shielding the circuit board from the transformer with a 2½" × 3½" plate of sheet steel. As can be seen in the under-chassis photograph, this shield is mounted directly between the power transformer and the circuit board with a slightly larger rectangle of thin cardboard between the shield and circuitry to prevent shorting the PC runs together. The longer wire ends protruding below the PC card were also trimmed with a pair of side cutters to keep them from wearing their way through the cardboard. The shield is held in place by a nut soldered to one corner which is engaged by one of the screws holding the circuit board to the chassis.

The conversion steps described in this article are mostly simple circuit changes, but they often require the addition of several parts to the modified circuit. If you haven't worked much with printed circuit boards, you may wonder how additional parts can be added to an existing foil pattern. Actually, there are several ways to accomplish that feat.

First, there are lots of unused foil islands on this board. Most of these were supposed to be used in the addition of optional features and so are available to use when making circuit additions.

Next, there is a lot that can be done to add parts by modifying existing foil runs. Often in changing a circuit a long foil run is freed up when the component or circuit at one end is no longer needed. A sharp knife can be used to cut and remove a short section to open the circuit, and then the remainder of the run can be sectioned into several other islands. To make connection to these islands, a small hole can be drilled next to the foil (runs are so narrow that drilling a hole through them can ruin them) and the paint scraped off the copper to permit soldering.

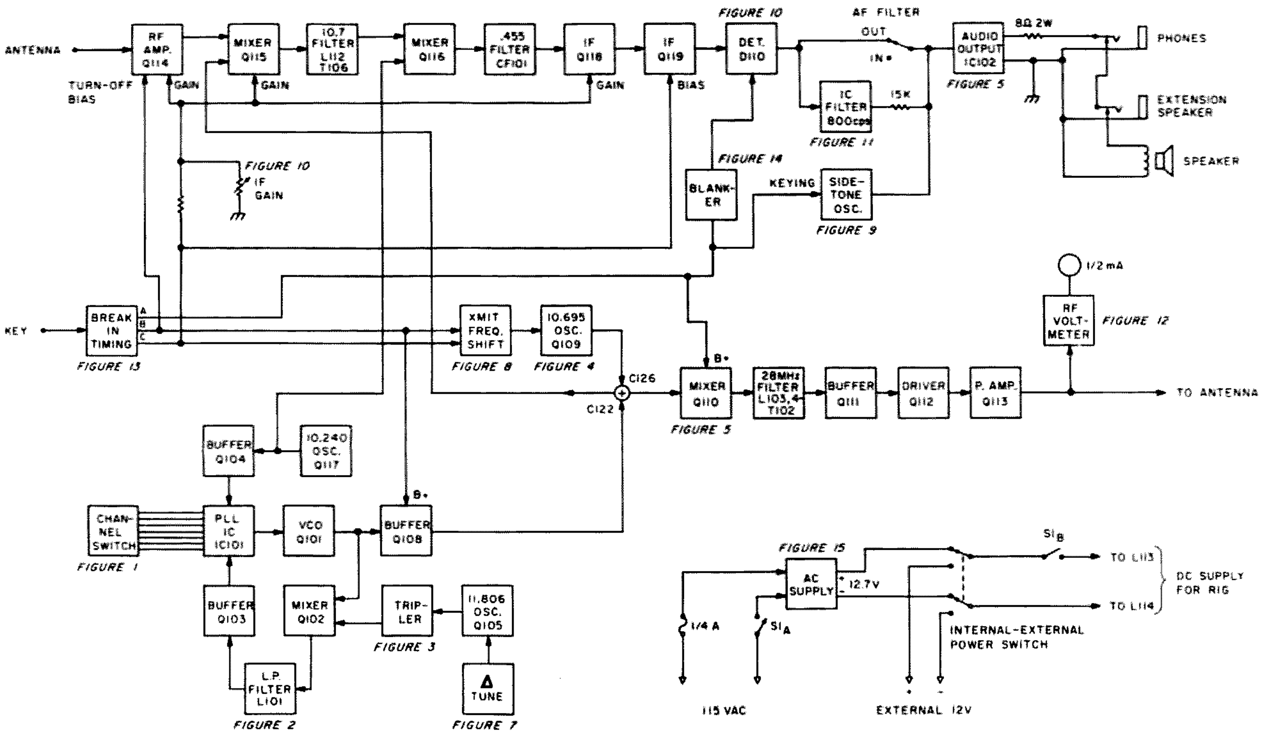


Fig. 16. Block diagram of the converted transceiver.

Be sure to leave the section of copper long enough that the whole strip won't come unglued when you solder to it. Remember that for modification purposes the primary need is for component support since the actual circuit connections can be made with small insulated jumpers. To provide adequate support, it is not necessary that each of a component's leads be anchored to the foil. It is quite acceptable, for example, to have a small resistor standing upright with only one end actually soldered to the board and the top end connected elsewhere with a jumper.

It is also possible to make connections by soldering new leads to other wires where they come out on the top of the circuit board, though this technique is less desirable because it can mean that to disconnect one component may require unsoldering several.

The principal thing to remember when you're looking for a way to add a component is that you're modifying the board, not manufacturing it. Amateurs often unconsciously accept the manufacturer's techniques as ideal standards when actually the manufacturer laid out the board the way it is only so that it could be built efficiently and reliably by the people and machines on his production line. The techniques suggested here, while certainly not as efficient in construction time, can be just as reliable as the manufacturer's if they are applied neatly and carefully. Take the time to make good neat solder joints. If a part seems loose on top of the board or a component wire has to support a heavy mass, use a dab of epoxy to help carry the load. A lot of the problems I had with these boards were due to something like a support wire on one of the output coils coming loose on the underside of the board and causing intermittent open circuits. A little care in construction can make a big difference in reliability.

This project got started because the basic circuit board was so cheap that I just had to find a use for it. The guiding philosophy has been to keep the cost down by avoiding expensive or exotic parts. There are no crystals to be ordered and no strange ICs you have to mail away for; if your junk box doesn't have what you need, the local parts store probably does. This design approach has produced a rig whose performance is better than I had expected, but there are still improvements to be made by the experimenter. The thing which has the biggest payoff potential is an improved bfo. The 10.695-MHz technique works, but the bfo signal passes through all of the i-f stages of the receiver and that puts a limit on the i-f gain usable (before the receiver chokes on its own bfo) and probably generates some spurious responses as well. A bfo at 455 kHz has several advantages aside from the i-f considerations: The detector stage could be replaced with one of the simpler product detectors for better linearity, a separate agc detector could be included and the agc put back into service, and (though much less important) the S-meter could be hooked back up. There are two ways to go about adding the bfo—with and without a crystal. If you have or can get a 455-kHz crystal, you're all set; otherwise, you might try making a free-running oscillator with an old i-f transformer. The free-running version may work fine—after all, the frequency is low and drift certainly isn't the problem it used to be in the vacuum tube days.

In closing I would like to express my appreciation for the photography and help with the text tendered by Steve W1GSL. In a project of this size, it is easy to get lost in small details, so an impartial but informed observer is an invaluable aid.■

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Hands Across the Water

—CW lives on historic Cape Cod

The operator casually twirls the passband control of a $7,000 Watkins-Johnson receiver as he peels another CW signal off the side of a noisy pileup. He's been at it—slapping out 20-word-per-minute CW—for almost eight hours now. Soon his shift will be over and someone else will take his place.

As he concludes another contact, he habitually spins the antenna switch, sampling the various rhombics he uses for receiving while trying to pull yet another signal up out of the pack that has zero-beat on top of him. Europe, the Med, the Persian Gulf, Africa, the South Atlantic—as the rhombics click by, one signal finally surfaces above the rest.

Tapping his bug in response, the operator keys his remote transmitter. From the shore of a sleepy tidal marsh green with sea grass five miles away, his antennas—mostly doublets, dipoles, and curtains—march out toward the rolling Atlantic. Two 4-500s drive two 4-5000s and his signal is easily heard on the other side of the world.

After a brief exchange of formalities, the text of a message is passed between another ship at sea and the largest and oldest commercial CW station still operating in the United States: RCA Globecom's WCC. In a few minutes the shift will end, the paddle will be passed, and another watch in the life of a professional CW operator will come to an end on Cape Cod.

CALL	NAME
KB1AO	Ronald Farris
N1AVT	Walter Doucette, Jr.
K1GRM	James Richards
W1JE	William Fishback
W1KL	William Ryder
K1LJS	Lewis Masson
W1SCD	William Pyne
WA1SIY	Timothy Call
K1TV	Ralph Siebert
K1WF	William Farris, Jr.
K1WT	Wallace Turzyn
KA1YT	Phillip Davis
W4GEX	Robert Norloff

Fig. 1. List of hams working at WCC.

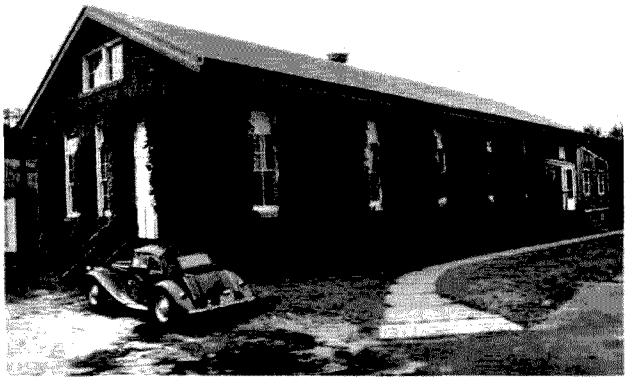

Fig. 2. In this rustic, ivy-covered building with a history as long as radio communication itself, 900 messages a day are handled by 21 professional CW operators, almost half of whom are hams.

Back In Time

Visiting WCC, RCA's marine message-handling station in the town of Chatham, Massachusetts, a good ways out on Cape Cod, is like taking a trip back through time. Once there, you're back in the Golden Age of shortwave radio communications. The rustic ivy-covered brick buildings, erected by the Marconi Company in 1914 (only eleven years after the first transoceanic radio

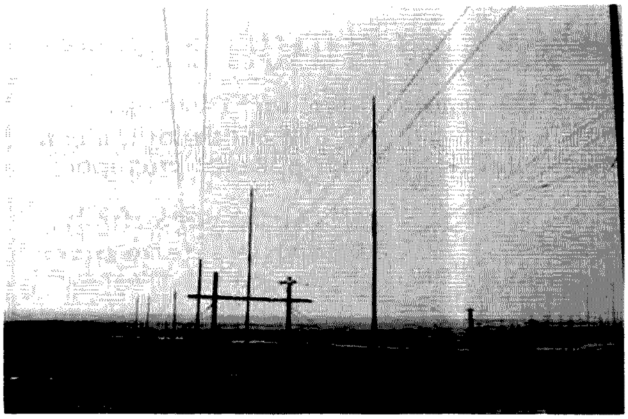

Fig. 3. At a remote transmitter site on the edge of a tidal marsh, WCC's antennas march out toward the Atlantic Ocean. These doublets and dipoles are fed with 10 kW of rf on 6, 8, 12, 16, and 22 megahertz.

message was sent from nearby South Wellfleet), are still intact. Most stand vacant now, victims of a technology to which they helped give birth. One, however, is as busy as ever.

Though methods of long-range radio communications have changed drastically during the last 60 years, the nobility of WCC remains. This station, which once provided weather information for Charles Lindbergh, maintained contact with Richard Byrd on his ill-fated trek to the pole, and monitored, then lost, Amelia Earhart's distant transmissions, has survived. And, in spite of the pressures for modernization, development, and progress surrounding them, these buildings, like the CW they shelter, are holding their ground in 1982.

What impresses most on a visit to WCC is the fact that in this high-speed, packet radio, orbiting-satellite world we live in, there is still a place where the Morse code is hammered out twenty-four hours a day, for a profit.

Edgar Hammons, manager of WCC: "Well, though we've seen a gradual decline over the last four years in the number of CW messages we handle, we're still quite busy." Though it may be on the decline, the WCC CW traffic list is, nonetheless, impressive. During the course of one twenty-four-hour operating day, 900 messages will be handled by WCC—most of them on CW. In rotating shifts, the station's 21 CW operators provide thousands of ships at sea with a reliable and inexpensive means of contacting their home offices.

"Satellites and digital communications are fine," says Hammons, but, he adds, "they are also extremely expensive to install and maintain." A modern shipboard satellite terminal can cost a ship owner over $50,000. As a result, many owners cling to CW and WCC as their only reliable communications link.

In addition to conventional CW, WCC offers customers with the proper equipment SITOR communications services. SITOR (Simplex Telex Over Radio) operates as an answer-back RTTY system. Running at 75 baud (50 wpm), SITOR transmitters and receivers at WCC echo message characters back to the ships that transmitted them. The result is error-free automated copy. In some instances, SITOR-equipped ships and their home offices can be connected directly through WCC for more private (and

Fig. 4. A new sign welcomes visiting amateurs to RCA's oldest commercial radio facility.

expedient) communications. A three-minute SITOR exchange with WCC costs an American ship about $9, a substantial savings over the CW rate which is based on a 52¢-per-word charge.

For the time being, however, CW is still the mainstay of WCC operations. After the hourly traffic list is broadcast by the station on the 4-, 8-, 12-, 16-, and 22-megahertz marine bands, CW signals pile up for each of the eight operators manning the shift. Once he establishes contact with a ship, a WCC operator types the text of the message he has received or sends the text of the message he is holding. Received messages at WCC are passed to one of three printer clerks via a small conveyor belt. The printer clerks then key the typewritten messages into a teleprinter that connects directly to an RCA message-center computer in New Jersey. At this point, the computer takes over and automatically telexes the message to its final destination.

The obvious thing about WCC's message-handling procedures is that they are highly labor intensive: It takes a lot of people to get a message delivered. According to manager Hammons, however, staffing the station poses little problem, despite its location on remote Cape Cod. "We have no openings here at present," says Hammons, "although we frequently do. In fact," he adds, "I have two applications for CW operator in my desk drawer right now. Tell your readers that I'm always glad to get new applications, though."

WCC's operating staff numbers 34; 21 are CW operators, nine are marine telex clerks, and four are technicians. There are 13 hams on the staff (See Fig. 1), almost 40% of the total employees! The starting salary for a CW operator is approximately $23,000 per year and the present contract calls for 10% yearly increases in wages.

Where does WCC find professional CW aficionados to man its station? Basically, there are two sources. Station operators come from the ranks of the military or from the ranks of amateur radio. Of the 21 full-time CW operators at WCC, eight are hams. In addition, all four technicians who attend to the day-to-day equipment maintenance and repair are hams.

Standard equipment for

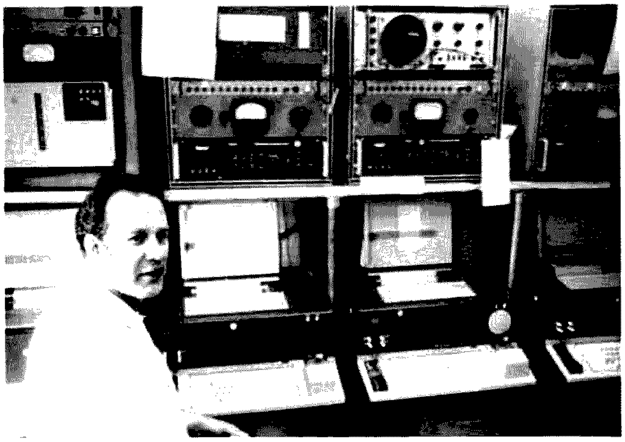

Fig. 5. K1TV manning the SITOR transmitter.

Fig. 6. A typical WCC operating position. Emphasis is put on receiver performance and typing ability.

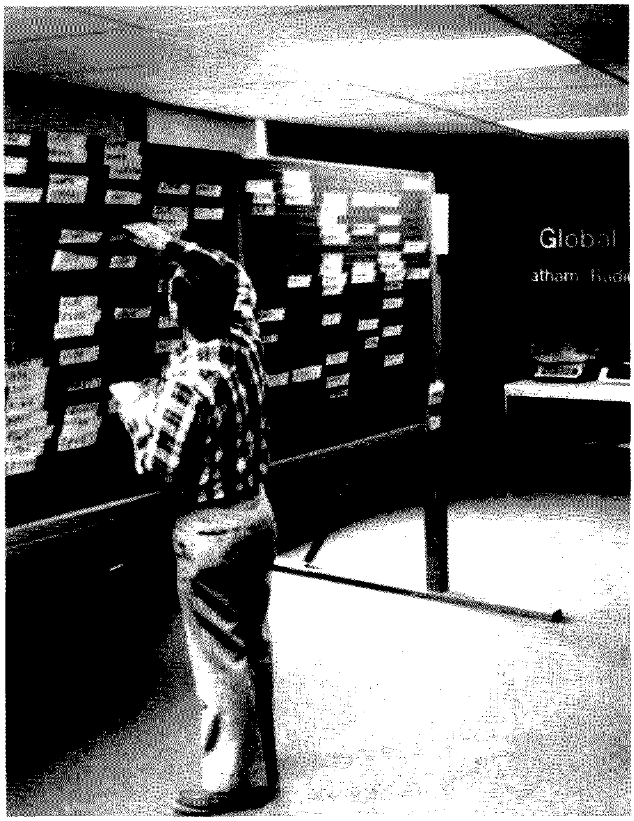

Fig. 7. Outgoing traffic is posted on the WCC message board. Between 700 and 1000 pieces of traffic are handled on a typical day.

hams operating at WCC includes a second class commercial telegraph license and a well-worn Vibroplex bug. Hand keys are available at each operating position, but, in a partial concession to modernity, most operators prefer to use their own mechanical keyer. No electronic keyers are in evidence, although one ham on the staff has been experimenting with the use of a CW keyboard.

Traffic at WCC is usually passed at around 15 words per minute but, in some cases, more slowly if the shipboard operator is not up to speed with the WCC crew. The quality of the code coming into WCC, both in tone and in style, varies. Some shipboard signals chirp like late-night Russian DX on 40 meters, and some of the fists sending these signals are straight out of the Novice bands.

Through it all, however, the cool professionalism of the WCC crew prevails. It is only rarely that the text of a message must be repeated by a tired operator in a distant port of call.

The Future at WCC

The future of WCC as a CW operation is open to question. Ed Hammons, conceding that CW is being eclipsed by the more cost-effective SITOR system, thinks CW will be around for some time, however. "I believe that we will always have Morse code," he said, adding that, "eventually it may not be the biggest segment of our business." Hammons went on to say that SITOR is gaining in popularity rapidly and that, at present, WCC is handling a new ship on SITOR almost every day.

For the CW operators at WCC, all of whom take turns babysitting the SITOR equipment now and then, CW remains more than a business; for most, it is a passion. One of them who argued most adamantly for the maintenance of high-quality standards on CW, as well as for the retention of CW as a requirement for amateur licensing, was not even a ham. He simply felt that CW was "something special, something human" in our digitally-automated world of tomorrow.

Sentimentality aside, the fact remains that a substantial portion of the message traffic that passes between the U.S. merchant fleet and their home offices in this information age in which we live does so via CW. For beleagured CW stalwarts who constantly find themselves on the defensive when confronted by their SSB- or ASCII-loving ham brethren, that may be comforting to remember.

It may also be reassuring to remember that, should the cares of this modern information age become too great, there is an alternative. In a quiet village on old Cape Cod there is an ivy-covered building with a history as long as radio communications itself where a CW-loving ham can earn a decent living by pounding out ten kilowatts of Morse for all the ships at sea. All he needs is a love of CW and a well-broken-in, vintage Vibroplex bug.

Amateurs visiting Cape Cod are welcome to tour WCC. The station management requests that all visits be made between 8 am and 4 pm, weekdays only, and, when possible, arranged one day in advance. ■

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A Three-Piece CPO

—battery not included

Recently, I had need of a code-practice oscillator to teach a Girl Scout troop how to properly send the international distress signals. We had already learned the emergency signals for ground-to-air, railroads, and the trucking industry. (How would *you* signal an oncoming train that a bridge was washed out?) It was just as important that the girls knew how to signal for help using Morse code. Hence, our program on emergency communications.

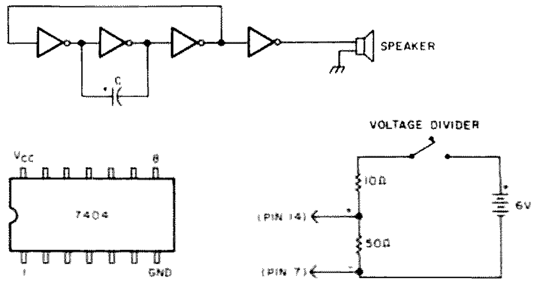


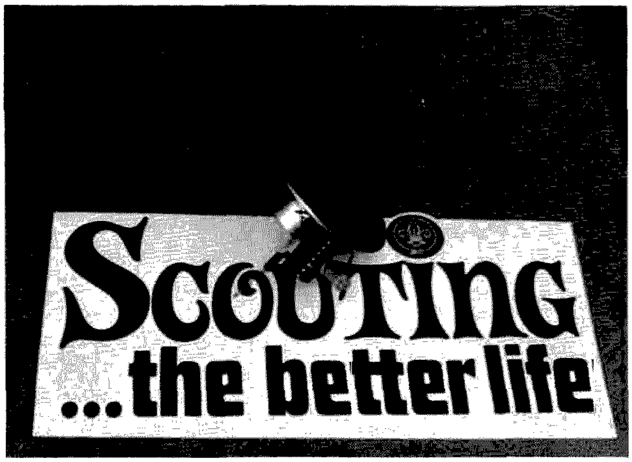
Fig. 1. The simplest cpo. The IC is a 7404 low-power Schottky hex inverter. C is a 5- to 30-μF electrolytic selected for desired pitch. The speaker is a 2-inch, 8-Ohm unit.

The cpo itself was built using 1 IC, 1 capacitor, and 1 speaker! The volume was sufficient for our meeting area and four C-cells wired in series provided the required 6 volts. Did I say 6 volts? Oh, yes, not wishing to build a 5-volt power supply (as required by the Schottky IC) for the circuit, I just used a voltage-divider network consisting of two resistors wired in series with the battery pack. One resistor was 10 Ohms, the other was 50 Ohms. The 50-Ohm resistor will function just like a miniature 5-volt battery. One end of the resistor will be the positive terminal and the other end will be the negative terminal. The current drain of the IC is so small that there is no problem with this arrangement.

The circuit was soldered directly to an IC socket and the speaker. I could have soldered directly to the IC pins, but happened to have a spare 14-pin socket in my junk box.

I used two 100-Ohm resistors in parallel to produce 50 Ohms. A standard 51-Ohm resistor would have worked just as well, as the maximum voltage for the IC is 5.25 volts.

The schematic diagram is self-explanatory. Build it and enjoy! ■



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Coherent CW for VHF

—will it work?

The so-called system of "coherent CW," which is actually a form of matched filtering with extremely narrow bandwidths, has been applied to the high-frequency spectrum and should have interesting VHF applications. Information is typically communicated at a bandwidth of only 10 Hz, resulting in a remarkably high signal-to-noise ratio. Successful contacts have been carried on at low power levels (such as 1 Watt) on 80 meters and over long distances (California to Asia) on 20 meters.

Interesting technical byproducts have been the development and use of the Petit filter with readily adjustable narrow bandwidths, the production and use of high-quality frequency synthesizers, and major advances in frequency stability, along with greatly improved methods of frequency measurement. Another important factor is the use of keyers with precision timing and phasing for each bit of each Morse element, using either the Accu-Keyer or special computer keying programs.

To our knowledge, the application of all of these technologies has not been made to VHF communication, but some of them may hold promise for important future advances at these higher frequencies.

Why Narrow Bandwidth at VHF?

The use of FM and the promise of packet communication of digital information at high speeds has drawn attention to the advantages of the wider bandwidths available at VHF. But for some applications, a completely opposite approach may be better. Suppose that we would prefer to get maximum range or highest intelligibility for only a brief message or one that might just as well go slowly. This could be, for instance, where the most important information might be evidence of contact through call letters and a signal report.

Let us make a simplifying assumption (not exactly true) that the methods of modulation and detection would be the same for either wide- or narrow-bandwidth communication and that the bandwidth required is the same as the bits sent per second. Curiously, 10 kHz completely filled for one second with 10,000 bits of information (as in a packet) would transmit exactly the same number of bits as 1,000 separate channels, each 10 Hz wide and each transmitting only 10 bits during the second (as in CCW). Noise power on each channel is proportionate to channel bandwidth. So, for the same signal-to-noise ratio, each narrowband signal using one milliwatt would do as well as the packet transmitter using 1 Watt. All the narrowband stations together would use

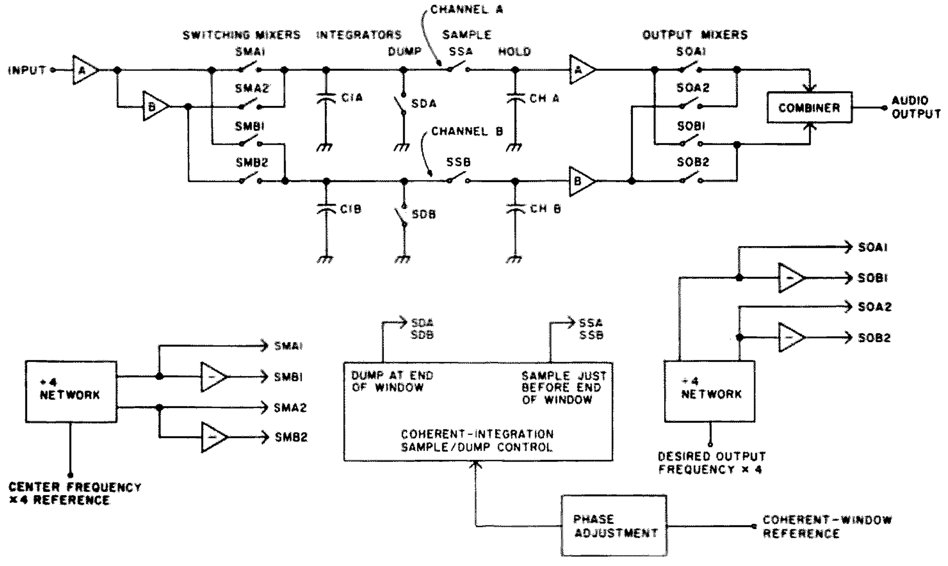

Fig. 1. Block diagram of the Petit filter (originally appeared in QST, May, 1981).

1 Watt—or if we preferred to use only one channel, we would use the same total amount of energy by taking 1,000 seconds to send the same message!

Thus, neither method has an inherent advantage in bits of information per unit of transmitted energy. So our choice will be made by whether we prefer speed at higher power or slowness at lower power (or perhaps greater range at the same power, at the sacrifice of speed).

We should note that if the total time is minimally used by packets or if the total frequencies are minimally used by lower-power narrowband signals, the chances of interference to either mode by the other mode in the same frequency range are very slight. Each tends to be immune to the other. (This will not apply, of course, if some greedy DXer tries a kilowatt on CCW!)

The Narrowband Matched Filter

We usually think of Morse code in terms of dot and dash patterns, each attached to a particular letter, number, etc. But Morse can be just as well conceived as a digital system based on an "on" (= one) or "off" (= zero) condition during a series of equal time intervals. Each time interval would be the length of a dot. A dot is a single one. A dash becomes three consecutive ones. A space within a character is usually one zero, between characters is three consecutive zeroes, and between words is seven consecutive zeroes.

If the timing of the Morse transmitter is precisely controlled, it will be sending a serial stream of digital information in classical binary form. Then a receiver can be constructed with a filter and detector carefully matched to decipher the digital message.

Despite the title of "coherent" CW, there is no way to preserve the phase coherence between the transmitted and received waves. Ionospheric or tropospheric media always cause some phase disturbances. The true essence of CCW is in the use of a matched filter.

At code speeds used by amateurs, bandwidths of matched filters can be extremely small. Typical dot lengths are a tenth of a second, producing about 12-wpm code speed. A Petit filter matched to such a signal has a 3-dB bandwidth of only 9 Hz. This allows for an outstandingly good signal-to-noise ratio.

The Petit Filter

The Petit filter refers to a design by Ray Petit W7GHM. Although the details of its circuit are described in the bibliography at the end of this article and will not be repeated here, a block diagram is shown in Fig. 1. The filter has several distinct features:

1. It operates near zero beat. Usually the filter bfo is at 1 kHz and it tunes to a receiver signal output very close to 1 kHz.

2. Two filter channels are used with a 90-degree phase difference between them. This quadrature phasing is necessary because near zero beat there is always the possibility that output in one channel alone might be in such a phase as to give almost no output. In that case, the quadrature channel output would be nearly maximum. Adding the two channels ensures an output whenever a signal is really present. The phase shift between the two 1-kHz-filter bfo signals is obtained by properly dividing 4 kHz by 4.

3. Matching is achieved by using a high-precision secondary frequency standard to control all functions on both transmitter and receiver. This not only ensures close tolerance in receiver tuning (within 1 Hz), but also close synchronization between received digital pulses and filter pulse sampling. A controlled-pulse repetition rate is not sufficient to hold this synchronization; the phasing of the time sampled by the filter must also be adjusted so that the transmitted signal is framed within a "window" opened to each signal pulse. Ten phasing-switch positions allow adjustment of the framing in 10-ms steps. Initial adjustment is made by listening for the clearest reception of a series of transmitted dots.

4. Each 100-ms window opening is the result of an integrating circuit in each filter channel. The integrated output is remembered for the next 100 ms by a sample-and-hold circuit. The latter either sets the level of a tone modulator for audio readout or else crosses a threshold for digital detection. At the end of the 100-ms interval, the output of the integrator is dumped by a shorting switch so that the next sample can begin. Note that the total independence of each sampling time interval disallows the "ringing" so common to very selective bandpass filters. Ringing is a condition of slow buildup and decay that can make a Morse signal sound so mushy as to be unreadable. The Petit filter is immune to ringing.

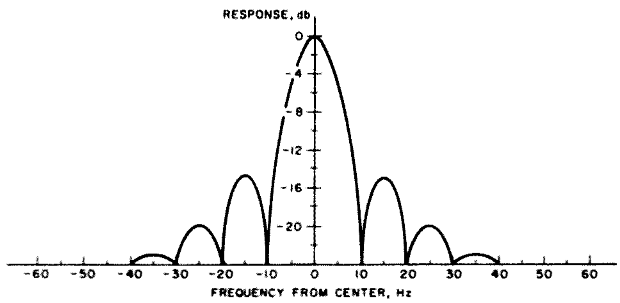

Fig. 2. Petit filter response curve (originally appeared in CQ*, June, 1977).*

The selectivity curve of the Petit filter is shown in Fig. 2. It does have side lobes that are still fairly high, although they remain quite close to center frequency. These side lobes might be diminished or eliminated by using other kinds of filters or by modifying the Petit filter. They are partly the consequence of the assumption in the design of the Petit type of filter that the Morse digital information is In pulses with zero rise and fall times—an inaccurate assumption.

Bandwidth may be adjusted easily by changing the sampling time interval. For instance, 1-second dot intervals will produce a bandwidth of only about 1 Hz, pulling signals out of the noise in a most impressive manner.

Signal-to-Noise Improvements

Some taped samples of 80-meter signals received by W3QVC and lab tests by W7GHM using the Petit filter are available for loan/purchase/copy from W3QVC at a minimal cost.

On an abstract numerical basis, signal-to-noise ratio is inversely proportional to receiver bandwidth. Thus, a 10-Hz-wide channel would give a signal-to-noise power advantage of 210 times (23 dB) compared to a 2100-Hz channel (a typical bandwidth for SSB voice communication).

In practice, the human ears and brain allow a degree of concentration on

the single tone of a CW signal that is the equivalent of a much narrower bandwidth than the wider filter would indicate alone. This effect has varying evaluations. One estimate (Woodson, *QST*, May, 1981) is that "this skill is worth at least a 6-dB margin when using a 2300-Hz filter. QRM, however, is often a confusion factor and therefore causes more degradation of copy than an equivalent amount of random noise. These psychological factors are difficult to quantify, but probably reduce the advantage of CCW over ordinary CW."

Woodson then gives comparisons of CW and CCW at different power levels in 14-MHz communications in 1975 between JR1ZZR and W6BB. Both modes were taped simultaneously on separate stereo channels and each channel was played back to four moderately experienced CW operators. The conclusion saw "an estimated 13-W CW signal as equivalent to a 0.1-W CCW signal in communications effectiveness, or a 24-dB superiority for CCW." (He should have said "21 dB" for that power gain.)

The taped laboratory experiments of W7GHM indicate that a CW signal 5 dB below the white noise level using a 500-Hz filter is just barely audible and only occasionally readable. The addition of a 10-Hz-wide Petit filter brings it to an easily copied level at what Petit describes as a "signal-to-noise ratio of 12 to 15 dB."

When Petit then drops a signal 14 dB below the noise and changes his filter to only 1-Hz bandwidth, the results are truly astonishing. The signal goes from completely lost in the noise up to 15 dB above the noise—a gain of 29 dB!

Frequency Stability

A narrowband system can work only if its overall frequency stability is within its bandwidth. Channels 10 Hz wide will tolerate errors of only a few Hz. Two factors affect frequency stability: (1) phase changes due to variations in the propagation characteristics of the medium through which the wave is sent, and (2) the accuracy of the frequency-control systems for the transmitter and receiver.

Phase changes during propagation set an almost absolute limit to the narrowness of the bandwidth that can be used. How could we imagine, for instance, that a VHF signal broadly modulated by the undulations of aurora reflection could be contained within a 10-Hz channel?

So far we do have some experience with CCW in long-distance HF communication. Woodson says: "For 14-MHz signals, motion in the F layer typically produces 2 or 3 Hz of phase (or frequency) modulation for a JA to W6 path. (We have also observed what appears to be propagation time delays under poor band conditions.)" Woodson goes on to speculate about VHF applications: "CCW might be used for EME communication, but the problem is complicated because of lunar-motion Doppler effects. One might need a computer to calculate the frequency at which the signal is expected to return."

A more practical solution to the Doppler problem with satellite repeaters might be reached through tight phase-locking to the satellite beacon signal, followed by computerized selection of the receiver frequency for a given transmitter. Even this would involve the solution of a complex puzzle.

VHF experimenters will have to discover what atmospheric conditions will allow the practical application of CCW to the VHF and UHF bands. Exactly what phase shift is introduced in tropospheric propagation? Can frequency modulation be confined to 2 or 3 Hz? On what bands, under which circumstances?

Questions like these, with answers not yet available, determine the ultimate possible narrowing of bandwidths. But the picture is less cloudy, indeed hopeful, when we consider the area of equipment frequency control.

Secondary Frequency Standards

The accepted frequency accuracy for HF CCW equipment is one part in ten to the seventh power. This allows for an error of not more than 1 to 2 Hz in either the transmitter or the receiver—adequate for 10-Hz bandwidths. The required precision is met by carefully constructed room-temperature oscillators with temperature compensation through suitable capacitors across the crystal.

VHF CCW calls for at least an order of magnitude of improvement in frequency accuracy. Frequency standards dependable to one part in ten to the eighth are not so simple. They use excellent crystals and both crystal and oscillator are enclosed in two concentric proportionately temperature-controlled ovens. The one ray of hope for amateur use of these standards is that they are available on the surplus market from time to time, currently costing about $75.

The setting of the exact frequency of such a standard is also a problem—but not unsolvable. HF propagation phase shift makes WWV unusable for most people for standardizing frequency to better than one part in ten to the seventh. Higher accuracies can be obtained from one of three comparisons: (1) with WWVB at 60 kHz, (2) with Loran C at 100 kHz, or (3) with TV network colorburst signals.

Comparison With Primary Standards

Don Gross has developed a receiver that allows the signal from WWVB to gate a frequency counter. The frequency of his secondary standard is multiplied by ten, resulting in a 10-MHz wave to be counted. By using 100-second gate times, his standard can be measured to parts in ten to the ninth. Counting errors are typically only 1.4 digits (or 1.4 parts in ten to the ninth) during the midday hours when 60-kHz propagation is most stable. The addition of a voltage-variable capacitor to the frequency standard allows easy trimming adjustments to a part in ten to the ninth. Drift is so slight that such trimming is needed only two or three times a week.

Such high accuracies are possible when WWVB is received on a good balanced and shielded loop antenna and when the receiver bandwidth is narrow enough to provide a good signal-to-noise ratio. The Gross receiver converts the 60-kHz signal to 1.11 kHz, where it passes through an N-path filter only 0.1 Hz wide. It is then re-converted to 60 kHz, limited and zero-crossing detected, then frequency divided to provide the counter gate control. Both the down- and the up-conversions use heterodyning frequencies derived from the secondary standard.

Bert De Kat has developed an effective and fairly simple method of measuring frequency by using Loran C. He uses a switch-controlled frequency-divider system to derive from his secondary standard the pulse repetition rate (PRF) of any Loran C station. (This divider is derived from Fig. 7, Burhans, *73*, May, 1978, ignoring the slave window timer.) He sets his PRF to

coincide with the nearest station and uses this locally-derived signal to trigger his oscilloscope. A broadbanded 100-kHz shielded loop and amplifier provide the Loran C signal to be displayed on the scope. By switching to a one-digit miscount in the divided frequency, the position of the display can be slowly moved across the screen until it reaches a suitable spot; the count is then corrected and the waveform stays in position. By using a high-grade oscilloscope, it is possible to expand any small portion of the 100-kHz waveform. By choosing the third zero-crossing of a pulse being built up, it is easy to keep track of the length of time that part of the wave moves across a measured part of the screen. This information can be used to measure the phase drift of the secondary standard. This measure is highly accurate, since the chosen part of the waveform is purely ground-wave and therefore stable in its propagation. Frequency is readily measured in parts in ten to the ninth or better.

Other methods of precise frequency measurement are covered in the bibliography.

Frequency Synthesizers

Since every frequency and timing element must be accurately controlled, high-quality frequency synthesizers are important. Ray Petit has done outstanding work in this direction. Although the bibliographic references to his synthesizers do not represent his latest developments, they show examples of excellent equipment that can be used to tune in either 100-Hz or 10-Hz increments, all phase-locked to the secondary frequency standard.

Keyers

The keyer that lends itself especially well to the timing requirements of CCW is the Accu-Keyer described in many issues of the ARRL *Radio Amateur's Handbook*. The oscillator part of this keyer is eliminated. A 10-Hz square wave derived from the frequency standard is connected in its place. This same 10 Hz is sent to the clock input of two D flip-flops: The Q output of one of these goes to the dot input of the keyer; the Q output of the other provides the dash input. The paddle (preferably a dual squeeze type) connects to the D inputs of the flip-flops. Debouncing can be arranged by connecting a resistor from each paddle output to the keyer positive voltage and a capacitor from each paddle to ground. CMOS versions of the Accu-Keyer are easily constructed and they are advantageous. The result of this circuit modification is a keyer that follows the desired CCW timing cycle to perfection.

Computerized keying is becoming increasingly popular. Some commercial keyers can be modified for the external timing and phasing required for CCW; others cannot. W3QVC had hoped that his M-80 Morse program for his TRS-80 would be adaptable to CCW. Although its keying speed can be fine tuned, its phase cannot be linked to the secondary frequency standard. As a result, with much that has been learned from volume 4 of the *Disassembled Handbook for the TRS-80* mentioned in the bibliography, he is encouragingly engaged in the production of a machine language Morse program for the TRS-80 (either Model I or Model III) that can use external clocking derived from his frequency standard.

Conclusion

CCW is just beginning to make its mark in amateur radio communication. With all the technological advances now at hand, there is every reason to consider the possible usefulness of CCW in the VHF range. There is plenty of room for new experiments! ■

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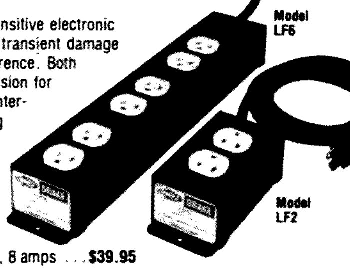

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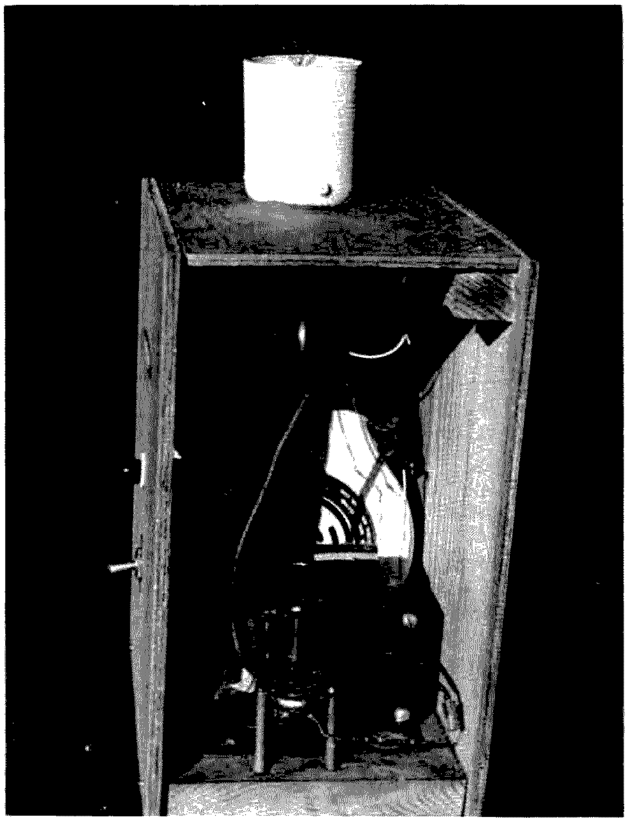
Electric Health via Negative Ions

— combatting an invisible menace

Scientists studying "ill winds" have unearthed some amazing facts. First of all, there really *are* ill winds, air masses that produce nervous and physical symptoms in weather-sensitive people.

In our country, these symptoms have long been considered purely psychological, or just in one's mind, but in other countries such as Germany and Israel, they have long been related to bad winds, the Foehn in Germany and the Sharan in Israel.



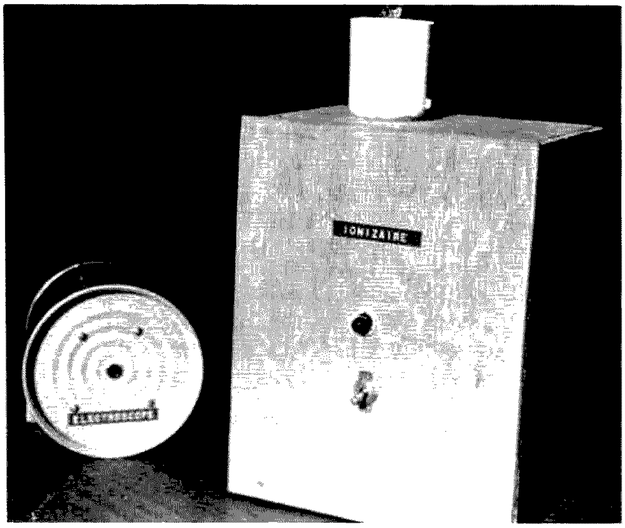
Inside the ion generator. Old hair dryer (without heating elements) is used to disperse ions.

Scientists have found that these air masses produce measurable changes in our bloodstream. And they believe they have found out how.

It seems that even before these winds sweep across an area, the positive ionization of the air increases enormously. In normal air, for every four negative ions there are five positive ions.

These positive ions in some way seem to increase the serotonin in the blood. This is a hormone whose properties are just now being investigated. Already we know serotonin has a great deal to do with our nervous condition, our moods, etc.

Before the ill winds come, the positive ionization of the air increases over 3000%. It's no wonder, then, that people can be affected. Doctors in Israel



Complete negative-ion producing and sensing system.

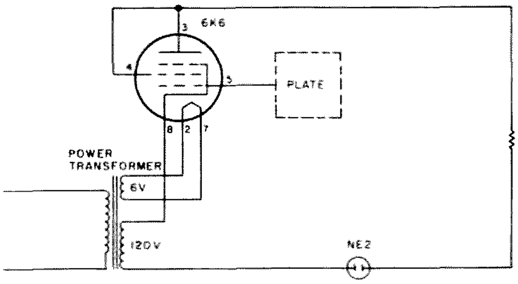


Fig. 1. Schematic of negative-ion-sensing electroscope.

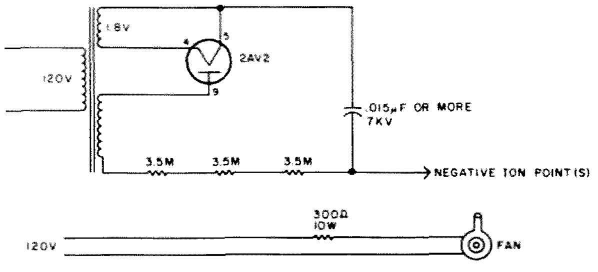


Fig. 2. Negative-ion generator.

often treat the nervous and physical ailments of their patients at these times by drugs that inhibit the action of serotonin, with almost magical results; moods change dramatically.

In our country, we also have such ill winds: the Santa Ana in California and the Chinook of the Rocky Mountains. You have perhaps experienced the exhilarating effects of the air at the seashore, near a waterfall, or in the mountains. In such places, the *negative* ions predominate.

As we become more and more "civilized," we also live in more completely air-conditioned environments. This air-conditioning not only warms or cools the air, it often deprives it of most of its negative ions. Air pollution outside our homes has the same effect. Tobacco smoke, besides being offensive to many noses, also depletes our working and living environments of negative ions, thereby adding to our nervous tension, so we pull out another cigarette, compounding the felony.

The mood we are in while we work is important. The Federal Aviation Administration is even studying the possibility that the imbalance in positive/negative ion concentration in cockpits may contribute to pilot error, resulting in dangerous situations for all on a flight.

This new knowledge of our environment and how it affects us has promoted the rise of several companies producing negative-ion generators, on the theory that if we can change the ion balance in our living or working environment to favor the negative-ion concentration, it will result in better feelings and better work, as well as help purify the air.

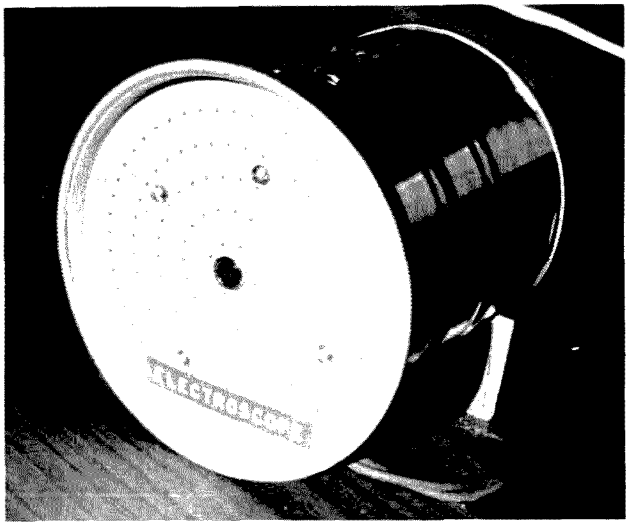
Most of these companies are really trying to give us something for our money, but some do it better than others. Some ion generators produce mostly ozone, which is not the negative ions we want; in fact, it has been found detrimental to health.

Later in this article I will detail how you can build your own negative-ion generator. But first we should have a way of telling whether we are really getting negative ions or positive ions or just ozone. We can't *see* any of these. Ozone we can detect if our nose is in good functioning condition, but only our moods could tell us whether there are too many positive ions in our environment.

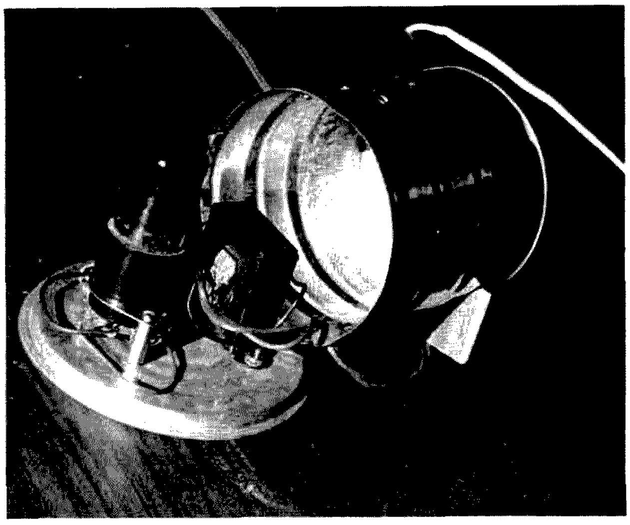
So, although we can produce our own negative ions, we need a method of detecting these helpful ions. What we need is a negative electroscope. You may be familiar with electroscopes used in high-school science classes, two-leaf affairs made of thin foil which separates when electrostatically charged. The difficulty with these is that they will react to either a positive *or* a negative charge. So we still are in the dark as to which ions we have generated, if any.

The Negative Electroscope

Fig. 1 shows how to build a simple *negative* electroscope which reacts to a concentration of negative ions. As you may know from your knowledge of vacuum tubes, a negative charge on the grid of a tube prevents current from flowing in the tube. In this circuit the grid is connected to a pick-up plate some five inches (13 cm) in diameter. When this plate is in a nega-



Outside view of electroscope.



Inside the electroscope.

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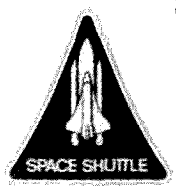

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tive field (negative ions produce a negative field), it places this negative charge on the grid of the tube and the neon bulb in the plate circuit goes out, showing that current in the tube has been cut off by a negative charge on the grid.

Any triode tube may be used, or a multi-element tube with the screen grid connected to the plate (ignore other elements except filament, cathode, and grid). If the cabinet is made of wood or plastic, you don't need the isolation transformer. But be careful that no high voltage is on any external surface.

I found an aluminum plate from a discarded percolator to be about the right size. I mounted the neon bulb (with its resistor) in the ready-made hole in the center of this plate. Then it was simple to mount a small filament transformer and the tube socket to the back of this plate. I didn't use an isolation transformer as only the plate connected to the grid can be touched from outside, and it has only the voltage of the surrounding air.

Usually the neon bulb will be on because the ordinary air conditions are positive, which allows some plate current to flow. Touching the plate will sometimes cause the neon to go out, but more often than not it will light brighter. You can experiment with this electroscope by combing your hair and bringing the comb next to the plate or walking across the carpet towards the plate. As you will find, most of the static charges produced are of a positive polarity and will make the neon glow even brighter.

The Negative Ionizer

To build the negative ionizer (Fig. 2), I bought a surplus 6-kV transformer, formerly used for a bug-killer. If you have an electronic background and don't mind the size of your ionizer, there is an alternative to a high-voltage transformer. If you have an old working TV set, you could, with some wiring changes, bring out the *negative* high-voltage lead of your TV flyback power supply and use it to generate your negative ions. The anode lead going to the picture tube is positive. In front of the ordinary TV set you will find an overabundance of positive ions. Perhaps this is partly the cause of our moody reaction to television!

I used an ordinary 2AV2 tube for rectifying the high voltage. If you have some very high-voltage diodes, these could be used, but they are not as tolerant of sparks and corona discharge as tubes are.

Build the whole ionizer in a wooden or plastic case or insulate heavily—five or six kilovolts is lethal! The extra 10-megohm resistor (actually three 3.5M resistors) is in the positive lead to ensure that anyone coming into accidental contact with the cathode, or negative-ion lead, will not be seriously shocked. According to Ohm's Law, this 10M resistance would allow about 0.7 mA of current to flow. You probably get much more than this in the thousand-volt shock you get by walking across the carpet and touching someone.

Despite this 10M precaution, shield the negative-ion point or cluster as well as possible from prying fingers. Be sure to keep the whole apparatus *out of reach* of children altogether. The shock that one can get from this ionizer is not serious but could easily produce a jerk of the arm that could upset and knock down the ionizer with more serious consequences. As when you open the back of your TV set, the best advice is: Don't! And the next best is: Know what you are doing and *be careful!*

The capacitor I used to store up the 6-kV charge was the 0.015-μF capacitor that came with the bug-killer. To build a better charge, a higher capacity could be used here (but be sure it is a high-voltage type). With the 6 kV, I had some trouble with arcing and corona discharge at the tube socket. The 10M resistor helped reduce this, and some anti-corona spray made it manageable. The corona discharge usually produces positive ions, so it is undesirable.

I first made the negative discharge element a point (a filed-down iron nail), but later added some extra points to increase the discharge. Perhaps you would like to use a piece of copper mesh such as is used in cleaning utensils. In any case, try to shield this in some way or keep it out of reach of children.

I found the 6-kV bug-killer transformer had enough space to wind a few extra turns on, to light up the filament of the 2AV2. If you can't do this or decide to use another rectifier, a separate transformer could be used for the filament. One advantage to using a high-voltage diode would be the saving of this extra transformer.

I also enclosed in my box an old hair-dryer blower (the heating element had burned out). In series with this I connected a 10-W resistor to slow it down a bit. In this way I had a slight breeze blowing up out of the ionizer to disperse the negative ions generated. But this is a refinement that may not be necessary.

"An ill wind blows no one good" says an old adage. Build this ionizer and be prepared to combat this invisible menace.■

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Houston TX 77098

The Very, Very Best CW Filter?

—costs under ten bucks

With dozens of published designs for audio filters, and with thousands of electronics engineers sitting around sipping wine and admiring their diplomas, however in the name of Hiram Percy Maxim do a couple of kitchen-table tinkerers get off calling this "The Very, Very Best CW Filter"? What makes this one worth your attention?

Well, for openers, we've got four aces:

- It works. (Slicker than a politician on the day before election.)
- The price. (How does less than $10 sound?)
- Adjustable bandpass. (Continuously adjustable from less than 30 Hz to full-open. That represents a Q of 25 down to a Q of nothing.)
- It's simple. (*You* can build it in less than an hour. You don't have to understand—just follow the pictures and the instructions.)

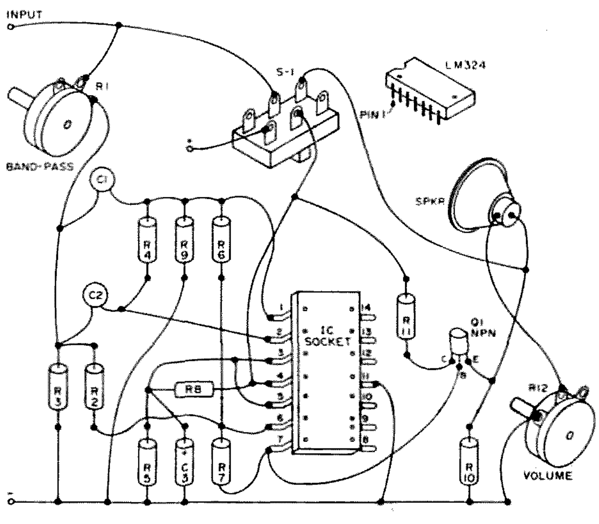


Fig. 1.

So if you're tired of crackles, pops, roars, whistles, and worse yet, interfering stations, this is the gadget for you. You can dial them out almost like magic!

The filter uses only one integrated circuit, the LM-324 quad op amp, which is available at Radio Shack for about $1.50. Also required are some resistors and capacitors, a speaker, and a power supply (batteries will do). If you'd rather travel by Cadillac than skateboard, add a phone jack and construct a power supply as shown in Fig. 3.

The design is nothing new—as a matter of fact, it is based on a filter design shown in the spec sheet for the LM-324. We have added to the design to provide for an adjustable bandpass, and we have tried to write simple directions for construction. Those who are experienced builders are not likely to need or follow our instructions, so we are writing for the person who has never, ever even seen an integrated circuit.

Decisions, Decisions, Decisions

OK, if you are convinced that you can live no longer with QRM and QRN, it's time to make some decisions.

(a) What kind of cabinet? How about a cigar box; maybe a small plastic box; or try one of those small metal card-file boxes from the stationery counter at Woolco.

(b) Chassis—Experienced builders will probably use perfboard or printed circuits, but beginners will probably do better with a small piece of plywood, about 3" × 5". Use small nails for terminals or tie-points, preferably soldered.

(c) Power supply—The operating voltage can be anything from 5 to 14 volts. The unit draws 120 mA at 9 volts. An ordinary 9-volt transistor radio battery will give about 4 hours continuous service, but four C or D cells in series will last several hours longer. (Later we will discuss the elimination of the transistor post-amplifier. Without the transistor, the unit draws only

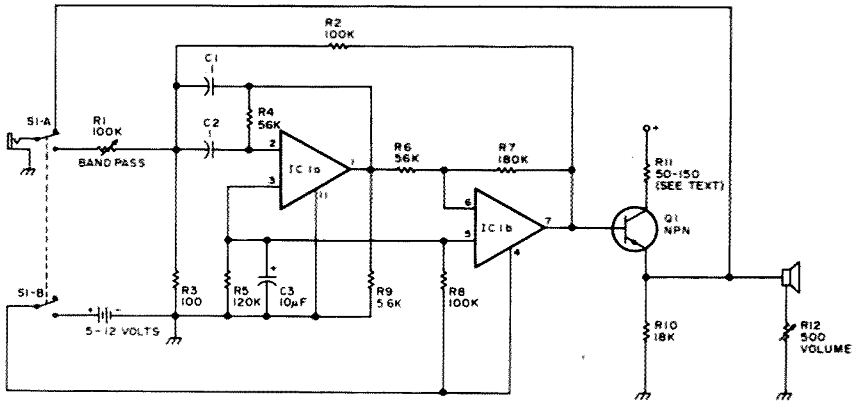


Fig. 2.

20 mA at 9 volts. Your battery would last a long time assuming you remember to turn off the power when the unit is not in use.)

If you opt to construct a power supply to operate from house current, try the one in Fig. 3. It's simple and inexpensive.

(d) Phones, speaker, or both?—The design shows a speaker within the unit, but if you feel you might want to use phones, install a phone jack. Sorry, we can't draw a picture for this; there are just too many types of phone jacks. Consider, though, that the output of the filter is at a constant volume regardless of the input. Many times you will hear a signal at full volume that you cannot hear at all with the unaided ear. You don't have to depend on phones to pick out the weak ones.

(e) Center frequency—This unit should have a center frequency (in its sharpest mode) of about 700 Hz. That is, *if* capacitors C1 and C2 are actually 0.1 uF. Unfortunately, capacitors are flighty things; the actual capacitances are almost never the same as the marked capacitances. So, "ye pays yer money, and ye takes yer chances." More likely, the center frequency will be about 5% to 10% below the designed center frequency. If you would like a different center frequency, the Design Notes give alternative component values.

About Construction

The LM-324 looks like a fat centipede. Pins are numbered counterclockwise beginning to the left of the notch when viewed from the top. (Remember, George, that's clockwise when viewed from the bottom or pin side.) Most ICs also have a small dot marking pin 1. If this is your first IC project, invest six bits in a 14-pin wire-wrap IC socket (that's the one with the long pins). It'll save a lot of cussing—believe it!

The bandpass control (R1) may be 50k to 100k Ohms. The filtering is sharpest when R1 is set at a high resistance, and when R1 is very low, the bandpass is so wide it seems there is no filter at all. When R1 is at 80k Ohms or higher, the bandpass is less than 4% of the center frequency, which is too narrow for ordinary CW use. Most noise disappears when R1 is set at about 30k Ohms, and a setting of 50k Ohms will narrow the bandpass to less than 40 Hz.

Make your connections to the power switch (S1) so that when the power is off, the signal is bypassed around the unit direct to the speaker. See the illustration in Fig. 1.

The transistor used as a post-amplifier needs to have a power dissipation rating of better than 1.5 Watts. The 2N2222 can handle this, but if you substitute another NPN, check it after a couple of minutes of use to see if it is heating too much. You may control this by putting 50 to 150 Ohms resistance between the plus voltage terminal and the collector of the transistor. (This is shown in the drawing as R11. Naturally, if the transistor you use can handle the power without overheating, you may eliminate R11.)

PARTS LIST
(All resistors ¼ Watt)

R1	50k Ohm to 100k Ohm variable resistor
R2, R8	100k Ohms
R3	100 Ohms
R4, R6	56k Ohms
R5	120k Ohms
R7	180k Ohms
R9	5.6k Ohms
R10	18k Ohms
R11	50 to 150 Ohms (see text)
R12	500 Ohm variable resistor
C1, C2	.1 uF
C3	10 uF
C4	1000 uF
Q1	2N2222 or equivalent NPN transistor (see text)
IC1	LM-324 quad op amp integrated circuit
S1	Double-throw, double-pole slide switch

Small speaker
Battery (see text)
For optional power supply see Fig. 3.
IC socket 14-pin wire wrap

The LM-324 filter produces reasonable volume into a small speaker without further amplification. If your shack is not noisy, simply connect one leg of your speaker to pin 7 of the LM-324 and eliminate transistor Q1 and also resistors R10, R11, and R12. The volume will then be enough to be heard clearly from a distance of 10 to 15 feet. (Remember the weak signals sound just as loud as the strong ones.)

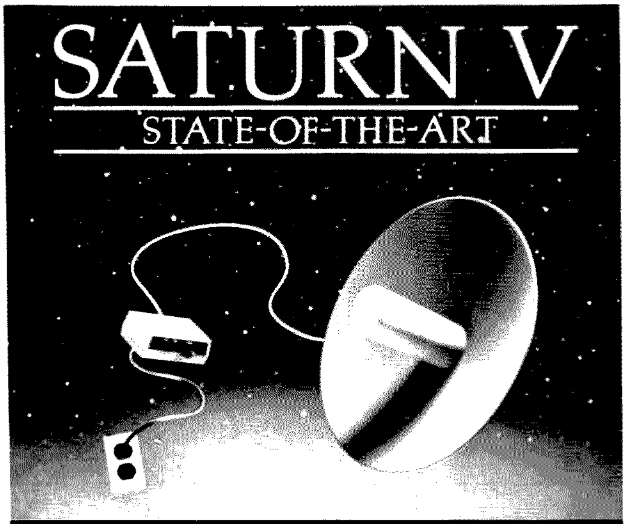
Using the Filter

Connect the input of the filter to the phone jack or external speaker connections of your rig. Turn R1 to

Design Notes
Desired Center Frequency

Component	710 Hz	816 Hz	850 Hz	1020 Hz
R4, R6	56k	51k	47k	39k
R2 (R4 × 1.5)	82k	75k	72k	62k
R3 (R4/623)	91	82	75	62
R5	120k	100k	100k	100k
R7 (R4 × 3)	160k	150k	150k	120k
R8	100k	100k	100k	100k
R9	5.6k	5.6k	5.6k	5.6k

(Computed to nearest standard values—R4 and R6 are considered critical. Other values may vary up to 25%.)



The Saturn V is a deep fringe microwave receiver for homeowners that are outside of the service area of local pay TV stations (i.e., HBO, Showtime). It is normally used within line of sight of a transmitting tower in a 50 mile range and is simply attached to your TV antenna mast. This unit is completely ready to install including all cable and mounting hardware. It is designed to be installed by the homeowner.

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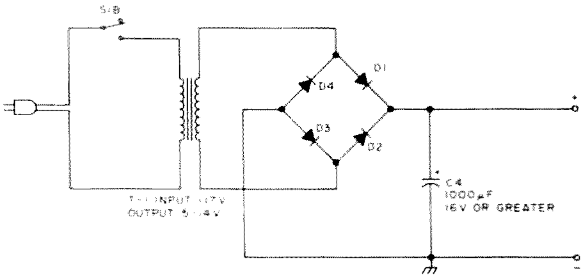

Fig. 3. Simple power supply. D1-D4 can be almost any diodes, or use full-wave bridge (Radio Shack 276-1161).

its lowest resistance setting. With the power on, you can hear both the desirable and undesirable as you tune across the band. When you have located the signal you want, narrow the filter by adjusting R1, bandpass control, until the undesirable is eliminated. (You may have to slightly retune your receiver as you tighten down on the filter, but you'll soon learn to recognize the center frequency and tuning will be fast and easy.) Keep the volume of the receiver as low as possible. If you get a chug-a-chug sound, you're using too much volume. Remember, the filter will pick up some signals when the volume is turned so low you can't hear them ordinarily.

We've tried to keep it simple—so if you're too tired to build this yourself, give this article and the parts to one of the kids. ■

Editor's Note

Shortly before publication, *73* learned that R5 should be changed to 68k for best performance. Please note this change.

✓453

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The True-Blue Keyer

—its speed readout doesn't lie

Editor's Note: The 8044 keyer chip used here is available from Curtis Electro Devices, Box 4090, Mountain View CA 94040; telephone (415)-964-3846.

This article describes a project that started as a typical electronic keyer and ended up including a self-contained readout that displays words per minute (wpm). This keyer is unique because of its ability to digitally display the speed in wpm of the keyer IC before either the dot or dash paddle is closed. Additionally, it will display the sender's speed in wpm during a CW transmission. These features were designed into the project using all CMOS technology and mechanical coupling between the keyer and image clocks.

The project features common keyer controls such as speed, volume, tone, weight, sidetone on/off, and transmitter tune with added front-panel switches for display calibrate and image/keyer display.

Circuit Operation

The use of a calibrated, tracking image clock is the circuit's simple method of generating a clock frequency when there is no clock output from the keyer IC, as in a standby condition. When the operator starts sending CW with the paddles, the logic circuitry transfers the wpm display from reading the image clock to reading the keyer clock. The display is updated every 1.2 seconds and will show the correct wpm after the first two update periods. A lower CW speed than the preset level will register if the operator is not sending at the proper rate and with the correct spacings. This feature provides visual feedback, telling the operator if his fist needs some correction. The display will never show a wpm level in excess of the preset value no matter how fast the paddles are actuated because the counter records only the number of clock pulses for 1.2 seconds generated by a particular frequency (speed) selected by the speed control.

Upon completion of the last CW character and, hence, the last keyer clock pulse, the display will show a reduced wpm or even zero for a short interval. Again, the logic functions and the display shows the output of the image clock.

Display keyer.

Circuit Description

The display keyer can best be described by separating it into three sub-circuits. The block diagram of Fig. 1 shows these circuits in their simplest form for those interested in following the logic sequence.

The heart of the system is the 8044 IC. This sub-circuit is shown in Fig. 2. Generally, I used the published circuit* with a few modifications. As shown in Fig. 2, these mods were not major circuit changes but just use of what the 8044 had to offer. For instance, the dot and dash terminals (pins 2 and 7) are normally high during standby. This was used very conveniently to drive the Exclusive NOR, U4a, a CD4077. Another connection to pin 8 of the 8044 was used for clock frequency pick-off to drive the counter and display circuit (Fig. 4) via an FET bilateral switch, U5a, 1/4 of a CD4066.

Another switch, U5c, was wired to the base of the 2N1613 driver transistor. This FET switch grounds the base of the driver transistor when U4b, pin 11 (Fig. 3), is high, thereby preventing the transistor from being keyed during clock calibration.

The output keying transistor, a 2N4356, is configured to drive a grid-block input circuit. Choice of this transistor will depend on your transceiver's grid-

*8044 Keyer Data Sheet, Curtis Electro Devices, Inc., revised February 23, 1979.

block voltage. My HW-101 presents −50 V dc at the key jack, so this transistor with its BVceo of 80 V dc has an adequate margin.

The final mod to the keyer circuit was the addition of the dual, 500k single-shaft pot. The keyer clock is controlled by R1A, while R1B (Fig. 3) controls the image clock frequency. Use of this dual pot mechanically couples the two clocks together to provide proper tracking and the correct wpm display during standby conditions.

The second sub-circuit is shown in Fig. 3. All of the switching and timing functions are controlled by this circuit. The positions of FET switches U5a and U5b as well as SW1 and SW2 are in a standby, ready-to-transmit mode. The logic states of the CD4077 that are useful for this circuit are L+L=H, H+H=H, H+L=L. The following logic states exist for Fig. 3 as shown. U4a pins 1 and 2 are high, thus pin 3 is high. U4c pin 6 is high and pin 5 is low, thus pin 4 is low. U2 is wired as a positive retriggerable monostable. With U2 pins 8 and 12 low, pin 10 will be low. U4d pins 8 and 9 are low, thus pin 10 is high. U4b pin 12 is high and pin 13 is low, thus pin 11 is low and U5c is open.

During standby conditions, the image clock, U3, wired as a free-running astable has its output pin 10 routed to the counter via the closed bilateral FET switch, U5b.

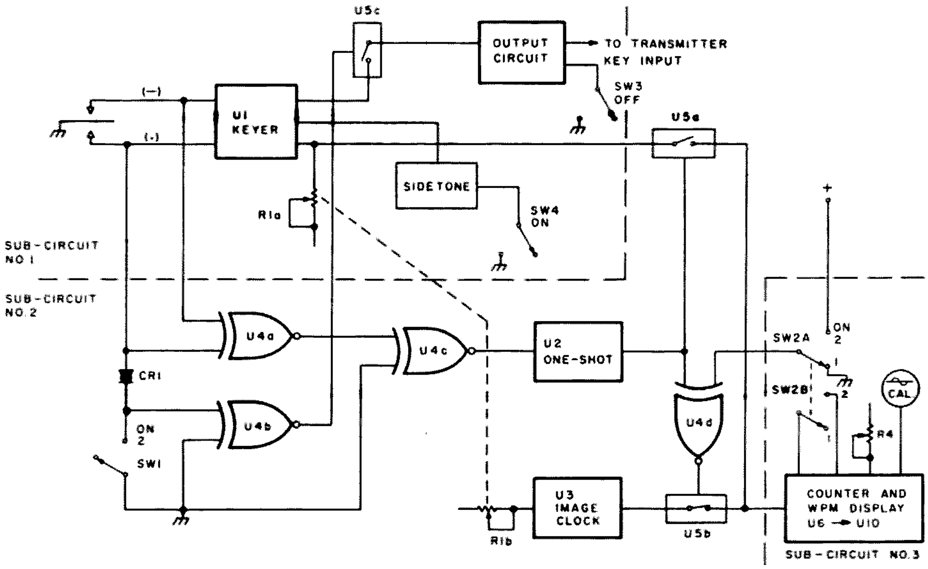


Fig. 1. Display keyer block diagram.

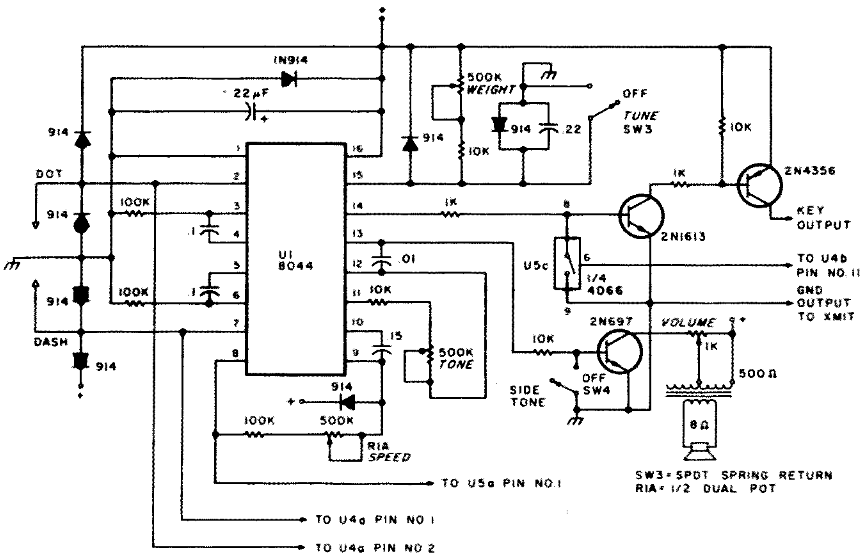


Fig. 2. Keyer and output circuits.

When a dot or dash paddle is closed, U4a's input state will become either L+H=L or H+L=L. As you can see, U4a's output will be forced low in either case. This low is inverted by the controlled inverter, U4c, whose positive output triggers U2. U2's monostable pulse width is set to four seconds by the 1 meg and 1µF RC combination. This pulse width was selected to accommodate low-speed operation, which may include long pauses. If the pause is greater than the pulse width, the display will revert back to the image clock. As long as this condition exists, the display will continue to show random numbers as it bounces between the two clock outputs. U2 pin 10 will remain high for positive retrigger pulses arriving at its input within the four-second on-time. U4d pin 8 now remains high, which forces pin 10 low and opens U5b. The high on U2 pin 10 also controls U5a, causing this switch to close and routing the 8044's clock output to the counter and display circuit. The display now registers the wpm of the transmitted CW up to the maximum set by the speed control.

The logic transfers just described will remain in effect until there is a pause greater than four seconds. Upon completion of the last paddle closure, either a dot or a dash, U2 is retriggered for its last cycle. After four seconds, all logic states will revert back to the standby condition, with the display showing the image clock wpm. During this transition, the display may show a double-zero indication because there is no clock output from the 8044 and U2 has not returned to zero on pin 10, closing U5b and opening U5a.

The image clock, U3, uses R1b for setting the clock output on pin 10.

Rcal is a 100k multi-turn trimpot required to calibrate the image clock so that it will properly track with the 8044 clock.

Fig. 4 shows the third subcircuit, the counter and display. Credit for this circuit goes to Howard F. Batie W7BBX whose fine article, "QRQ, QRS—By the Numbers," appeared in the June, 1980, issue of *73 Magazine*. The circuit description is throughly covered in this article, so further explanation would just duplicate his effort.

Dc power for all circuits is produced by an internal regulated power supply (Fig. 5). The 7808 three-terminal 8-V dc regulator was selected because it provides at least two volts of Vdd margin for the 8044 IC. This IC is rated for 10 V dc maximum while all other CMOS used have a 20-V dc rating. The 7808 is rated for 1 Ampere steady-state load. The circuits in this project can draw 200 mA, which is well within the 7808 rating, but the regulator must be bolted to a heat sink or it will destroy itself. The regulator's mounting tab is its ground terminal and therefore can be electrically attached to the chassis.

Calibration

The following description is based on all switches positioned as shown in Figs. 2, 3, and 4 and the paddles are open.

After ac power is applied, I suggest a warm-up time of five minutes. If all circuits are working properly, the display should indicate a two-digit number.

The 8044 IC is capable of 8 to 50 wpm with the values shown. The image clock was calibrated using Rcal and a speed setting of 30 wpm. This provides tracking within 1 to 2 wpm from 8 to 30. Above 30 wpm, I experienced difficulty in getting proper tracking because of nonlinearities in the image clock. If the speed control is advanced above 30, the image display will increase very rapidly and show a false number. At these higher speeds, with the paddles open, a momentary indication of the correct speed is available when the front-panel clock switch is transferred to the 8044 position. During CW transmission, the display will read correctly for any speed over 30 wpm.

SW1 is an SPDT spring-return switch used during calibration of the image clock

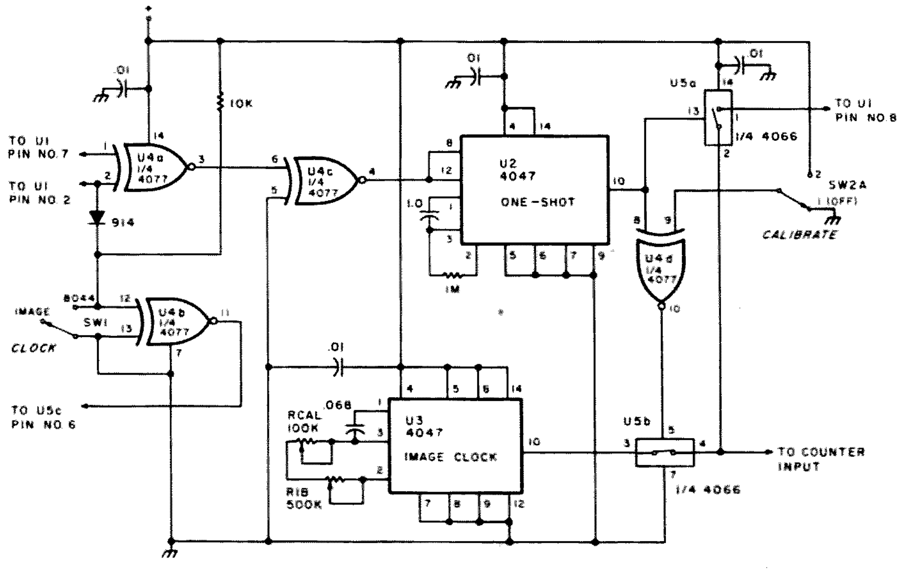


Fig. 3. Display sequencing logic.

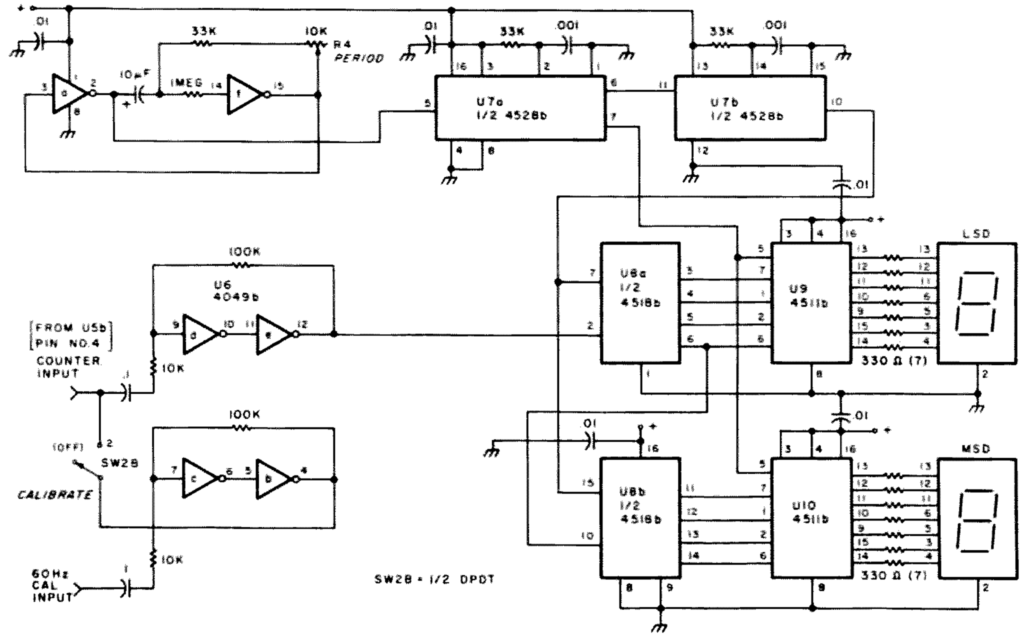


Fig. 4. Counter and wpm display circuit.

to match the 8044 clock. When SW1 is closed, the high on U4b pin 12 via the 10k pull-up resistor is grounded. This does two things: First, the 8044 is turned on through the 1N914 between U4a pin 2 and U4b pin 12. Second, U4b pin 11 goes high, which closes U5c, preventing any transmitter keying during clock calibration. The image clock could be calibrated by simply closing the dot paddle, but this is not recommended because the transmitter would be keyed unnecessarily.

SW2 is a standard DPDT toggle switch used to change the logic state on U4d pin 9 for counter period calibration. A high on pin 9 and a low on pin 8 will force U4d pin 10 low and open switch U5b. With switches U5a and U5b open, the counter input is open and ready to accept the 60-Hz calibration signal.

The counter circuit calibration uses SW2b to connect U6b pin 4 to the input of U6d pin 9. The remaining counter and display circuitry was used as it appeared in W7BBX's article.

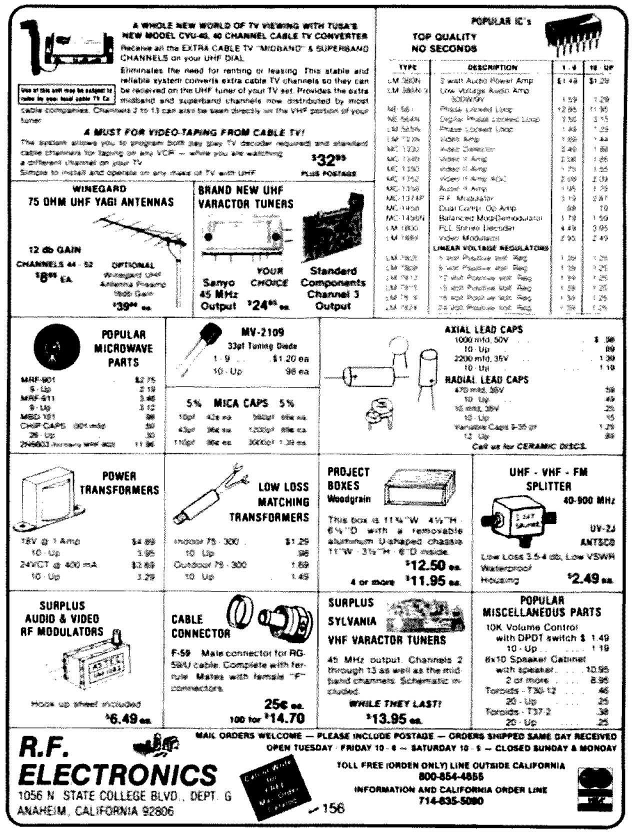
The first calibration step is to set the period, or gating time, of the frequency counter. This time period is controlled by adjusting R4 in Fig. 4. Incidentally, I recommend that a multi-turn trimpot be used for R4 to reduce the sensitivity of this adjustment. The calibration source is a low-voltage 60-Hz signal from the transformer secondary. With 60 Hz and a 1.2-second gating period, the wpm calculates to be 72. Therefore, with the front-panel Calibrate switch (SW2) up, R4 should be varied until a steady reading of 72 registers on the display. Remember to rotate R4 slowly, allowing the counter to count all the pulses during the gating time. When this step is complete, return SW2 to the down position.

The second calibration step involves setting the output frequency of the image clock to coincide with the 8044 clock at 30 wpm. Pressing the front-panel Clock switch (SW1) presents the 8044's clock to the counter/display circuit and registers it directly in wpm. The idea here is to adjust the 100k trimpot, Rcal (Fig. 3), so the image clock matches the 8044 clock. Next, release SW1 and adjust Rcal for the correct wpm. Rotate the Speed control (R1A/B) counterclockwise and check for proper tracking at lower settings.

This completes the calibration for the display keyer and only leaves the remaining keyer controls, which are self-explanatory.

Component layout isn't critical. For ease of fabrication and checkout, I constructed the counter/display circuits on one perfboard and the keyer with switching/timing logic on another. The power supply is mounted to a third perfboard with the 7808 near the center. The regulator's metal heat sink is connected to the rear chassis wall.

The display keyer project was fun to design and build and with its completion has added another dimension to my CW operation. The usefulness of the wpm readout has proved to be more than expected, with its constant reminder of CW speed. Besides being useful on the air, the project makes an excellent CW practice machine. The trainee can develop and improve both his speed and coordination using the display and sidetone as indications of his sending quality. ■



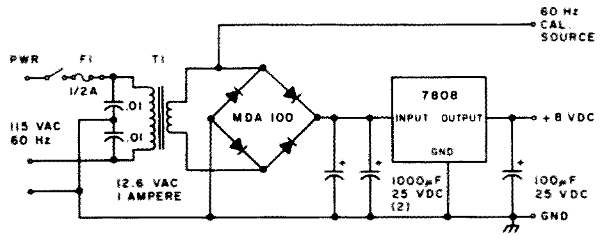
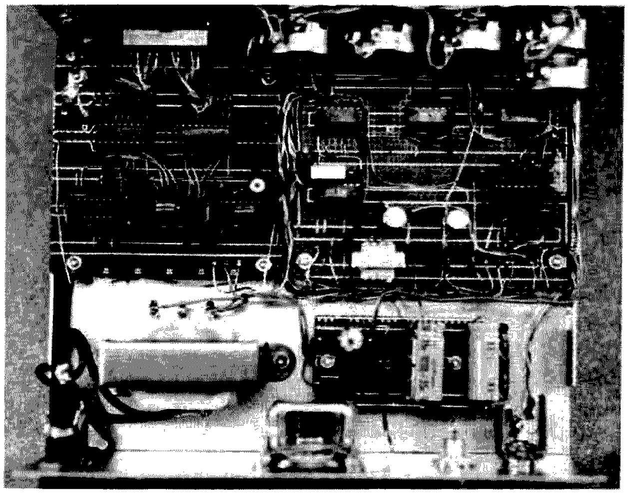


Fig. 5. Power supply.



Top view of the display keyer, showing the three perfboards. Speaker, ac fuse, input and output jacks are on the rear panel.

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Louis C. Graue K8TT
624 Campbell Hill Rd.
Bowling Green OH 43402

Touch-Type CW

—the TRS-80 way

Program listing.

```
                ;TRS-80  CW KEYBOARD BY K8TT (9/8/80)
                ;SENDS CW OUT THE CASSETTE AUXILLARY PLUG
                ;SHIFT KEY + UP ARROW WILL INCREASE SPEED
                ;SBIFT KEY + DOWN ARROW WILL DECREASE SPEED
                ;BREAK KEY CLEARS SCREEN AND STOPS OUTPUT
                ;TO ENTER MESSAGE: HIT @ THEN 1,2,3, OR 4 -
                ;      TYPE IN MESSAGE - HIT (BREAK) WHEN DONE.
                ;TO SEND MESSAGE: BOLD (SHIFT) & PRESS 1,2,3,OR 4.
                ;
                ;INITIALIZATION
4A00                    ORG     04A00H
4A00 CDC901     START   CALL    01C9H    ;CLEAR
4A03 3E00               LD      A,0      ;STOP OUTPUT
4A05 D3FF               OUT     (0FFH),A
4A07 3E5F               LD      A,05FH   ;TURN ON CURSOR
4A09 322240             LD      (4022H),A
4A0C 21003C             LD      HL,3C00H         ;SET OUTPUT CURSOR
4A0F 220050             LD      (5000H),HL
4A12 21006A             LD      HL,06A00H        ;INITIALIZE BUFFER
4A15 EB                 EX      DE,HL            ;DE IS REAR
4A16 21006A             LD      HL,06A00H        ;HL IS FRONT
4A19 3600               LD      (HL),0   ;NO OUTPUT BEFORE INPUT
                ;
                ;INPUT-OUTPUT CALLING SEQUENCE
4A1B CD234A     AGAIN   CALL    INPUT
4A1E CD674A             CALL    OUTPUT
4A21 18F8               JR      AGAIN
                ;
                ;STORE KEY ENTRIES IN BUFFER AND DISPLAY ON CRT
4A23 D5         INPUT   PUSH    DE
4A24 E5                 PUSH    HL
4A25 CDA54B             CALL    KEYSCN
4A28 E1                 POP     HL
4A29 D1                 POP     DE
4A2A B7                 OR      A        ;FIX FLAG
4A2B C8                 RET     Z        ;GO TO OUTPUT IF NO INPUT
4A2C FE01               CP      01H      ;IF BREAK KEY CLEAR
4A2E 28D0               JR      Z,START ;          & STOP SENDING
4A30 FE1A               CP      01AH     ;SPEED DECREASE
4A32 CA4B4B             JP      Z,DECSPD
4A35 FE1B               CP      01BH     ;SPEED INCREASE
4A37 CA544B             JP      Z,INCSPD
4A3A FE40               CP      40H      ;ENTER MESSAGE
4A3C CA1A4C             JP      Z,MSTART
4A3F FE21               CP      21H      ;MESSAGE #1
4A41 CA794C             JP      Z,MES1
4A44 FE22               CP      22H      ;MESSAGE #2
4A46 CAA84C             JP      Z,MES2
4A49 FE23               CP      23H      ;MESSAGE #3
4A4B CAD74C             JP      Z,MES3
4A4E FE24               CP      24H      ;MESSAGE #4
4A50 CA064D             JP      Z,MES4
4A53 E5                 PUSH    HL
4A54 D5                 PUSH    DE
4A55 CD3300             CALL    33H      ;VIDIO OUTPUT
4A58 D1                 POP     DE
4A59 E1                 POP     HL
4A5A FE08               CP      08H      ;ERASE LAST ENTRY
4A5C 2004               JR      NZ,NODEL
4A5E 2B                 DEC     HL
4A5F 3600               LD      (HL),0
4A61 C9                 RET
4A62 77         NODEL   LD      (HL),A
4A63 2C                 INC     L        ;BUMP BUFFER
4A64 3600               LD      (HL),0   ;ZERO NEXT BYTE  OF BUFFER
4A66 C9                 RET
                ;
                ;OUTPUT CW TO CASSETTE PORT  FROM BUFFER
4A67 1A         OUTPUT  LD      A,(DE)   ;GET  DATA
4A68 B7                 OR      A        ;FIX FLAG
4A69 C8                 RET     Z        ;GO IF BUFFER EMPTY
4A6A FE20               CP      20H      ;SPACE?
4A6C CA184B             JP      Z,WSPACE;IF SO, SEND IT
4A6F FE5B               CP      05BH     ;REJECT NON TABLE STUFF
4A71 F29A4A             JP      P,GOOF
4A74 4F                 LD      C,A      ;SAVE CHAR FOR SEND
4A75 D62C               SUB     02CH     ;MAKE START OF TABLE  0
4A77 FA9A4A             JP      M,GOOF
4A7A D5                 PUSH    DE
4A7B E5                 PUSH    HL
4A7C 6F                 LD      L,A      ;MAKE DATA 16 BIT
4A7D 2600               LD      H,0
4A7F 11754B             LD      DE,TABLE;GET BASE ADDR OF TABLE
4A82 19                 ADD     HL,DE    ;FIND ELEMENT BY INDEXING
4A83 7E                 LD      A,(HL)   ;GET CODE FROM TABLE
4A84 E1                 POP     HL
4A85 D1                 POP     DE
4A86 0608               LD      B,08H    ;BIT COUNTER
4A88 07         NEXT    RLCA             ;LOOK FOR 0 TO START
4A89 05                 DEC     B
4A8A 280E               JR      Z,GOOF   ;NO START BIT - NO SEND
4A8C 38FA               JR      C,NEXT
4A8E 07         MORE    RLCA             ;NEXT BIT  INTO CARRY
4A8F 3834               JR      C,DASH   ;IF 1 SEND DASH
4A91 CD9C4A             CALL    DOT      ;IF 0 SEND DOT
4A94 05         DARET   DEC     B
4A95 20F7               JR      NZ,MORE ;GET  NEXT BIT
4A97 CDF64A             CALL    CSPACE   ;SPACE AT END OF CHAR
4A9A 1C         GOOF    INC      E       ;BUMP BUFFER
4A9B C9                 RET
                ;
                ;DOT ROUTINE
4A9C F5         DOT     PUSH    AF
4A9D C5                 PUSH    BC
4A9E DDE5               PUSH    IX
4AA0 E5                 PUSH    HL
4AA1 3E2E               LD      A,2EH            ;INSERT DOT AS SENT
4AA3 CD694B             CALL    CURS             ;FIX SENDING CURSOR
4AA6 E1                 POP     HL
4AA7 DDE1               POP     IX
4AA9 3E01               LD      A,1
4AAB D3FF               OUT     (0FFH),A
4AAD CD5D4B             CALL    DELAY
4AB0 DDE5               PUSH    IX
4AB2 E5                 PUSH    HL
4AB3 3E20               LD      A,20H            ;CLEAR THE DOT
4AB5 CD694B             CALL    CURS
4AB8 E1                 POP     HL
4AB9 DDE1               POP     IX
4ABB 3E00               LD      A,0
4ABD D3FF               OUT     (0FFB),A
4ABF CD5D4B             CALL    DELAY
4AC2 C1                 POP     BC
4AC3 F1                 POP     AF
4AC4 C9                 RET
                ;
                ;DASB ROUTINE
4AC5 F5         DASH    PUSH    AF
4AC6 C5                 PUSH    BC
4AC7 DDE5               PUSH    IX
4AC9 E5                 PUSH    HL
4ACA 3E5F               LD      A,5FB            ;INSERT DASH
4ACC CD694B             CALL    CURS
4ACF E1                 POP     HL
4AD0 DDE1               POP     IX
4AD2 3E01               LD      A,1
4AD4 D3FF               OUT     (0FFH),A
4AD6 0E03               LD      C,03H
4AD8 C5         DAHDLY  PUSH    BC
4AD9 CD5D4B             CALL    DELAY
4ADC C1                 POP     BC
4ADD 0D                 DEC     C
4ADE 20F8               JR      NZ,DAHDLY
4AE0 DDE5               PUSH    IX
4AE2 E5                 PUSH    HL
4AE3 3E20               LD      A,20H            ;CLEAR THE DASH
4AE5 CD694B             CALL    CURS
4AE8 E1                 POP     HL
4AE9 DDE1               POP     IX
4AEB 3E00               LD      A,0
4AED D3FF               OUT     (0FFH),A
4AEF CD5D4B             CALL    DELAY
4AF2 C1                 POP     BC
4AF3 F1                 POP     AF
4AF4 189E               JR      DARET
                ;
                ;CHARCTER SPACE ROUTINE
4AF6 F5         CSPACE  PUSH    AF
4AF7 DDE5               PUSH    IX
4AF9 E5                 PUSH    HL
4AFA 79                 LD      A,C              ;GET CHARACTER BACK
4AFB CD694B             CALL    CURS
4AFE 23                 INC     HL               ;BUMP CURSOR ADDR
4AFF DD7500             LD      (IX+0),L         ;SAVE NEW CURSOR ADDR
4B02 DD7401             LD      (IX+1),H
4B05 E1                 POP     HL
4B06 DDE1               POP     IX
4B08 3E00               LD      A,0
```

I have been looking for a good program to make it possible for me to use my TRS-80 computer to send CW over the air. I wrote this one, with the following features:

- The transmitter is keyed through the cassette auxiliary plug and does not use the TRS-80 relay.
- Input and output speeds are independent so that you can type well ahead of what is being transmitted.
- The output speed can be increased or decreased at any time by holding the shift key and pressing the up or down arrow key.
- The input is displayed on the screen and can be edited before it is sent out by using the backspace key.
- The character being output is indicated by being removed temporarily from the CRT display, with the dots and dashes displayed in its place as they are sent. Afterwards the character is replaced. This goes on simultaneously with the addition of new characters. You always know exactly where the sending routine is operating.
- Messages can be typed out on the screen, edited, and then stored for later output. When called, the entire message is instantly placed on the screen in the proper sequence and is treated exactly like text you are typing.
- Hitting the break key will clear the screen and the buffers and stop the output.
- The output is perfect machine code of whatever is put on the CRT, including proper spaces.

Operation

Using Edtasm or Tbug, make an object program tape and load it. Operation is extremely simple. Just start typing and anything you type will be displayed and sent.

If you want a faster output speed, hold the shift key and press the up arrow key. Each time you do this, the speed is incremented. To decrease the speed, use the down arrow key in the same way.

To store a message for later use, first press the @ key and then key 1, 2, 3, or 4. Type in your message (up to 256 characters), edit it,

```
4B0A D3FF     01780          OUT    (0FFH),A
4B0C 0E02     01790          LD     C,02H
4B0E C5       01800 CSDLY    PUSH   BC
4B0F CD5D4B   01810          CALL   DELAY
4B12 C1       01820          POP    BC
4B13 0D       01830          DEC    C
4B14 20F8     01840          JR     NZ,CSDLY
4B16 F1       01850          POP    AF
4B17 C9       01860          RET
              01870 ;
              01880 ;WORD SPACE ROUTINE
4B18 F5       01890 WSPACE   PUSH   AF
4B19 DDE5     01900          PUSH   IX
4B1B E5       01910          PUSH   HL
4B1C 3E2D     01920          LD     A,2DH             ;SPACE MARKER
4B1E CD694B   01930          CALL   CURS
4B21 E1       01940          POP    HL
4B22 DDE1     01950          POP    IX
4B24 3E00     01960          LD     A,0
4B26 D3FF     01970          OUT    (0FFH),A
4B28 0E04     01980          LD     C,04H
4B2A C5       01990 WSDLY    PUSH   BC
4B2B CD5D4B   02000          CALL   DELAY
4B2E C1       02010          POP    BC
4B2F 0D       02020          DEC    C
4B30 20F8     02030          JR     NZ,WSDLY
4B32 DDE5     02040          PUSH   IX
4B34 E5       02050          PUSH   HL
4B35 3E20     02060          LD     A,20H             ;CLEAR SPACE MARKER
4B37 CD694B   02070          CALL   CURS
4B3A 23       02080          INC    HL                ;BUMP CURSOR
4B3B DD7500   02090          LD     (IX+0),L          ;SAVE IT
4B3E DD7401   02100          LD     (IX+1),H
4B41 E1       02110          POP    HL
4B42 DDE1     02120          POP    IX
4B44 F1       02130          POP    AF
4B45 FE20     02140          CP     20H
4B47 CA9A4A   02150          JP     Z,GOOF
4B4A C9       02160          RET
              02170 ;
              02180 ;SPEED CHANGE ROUTINES
4B4B 3AA44B   02190 DECSPD   LD     A,(SPEED)
4B4E C610     02200          ADD    A,10H
4B50 32A44B   02210          LD     (SPEED),A
4B53 C9       02220          RET
4B54 3AA44B   02230 INCSPD   LD     A,(SPEED)
4B57 D610     02240          SUB    10H
4B59 32A44B   02250          LD     (SPEED),A
4B5C C9       02260          RET
              02270 ;
              02280 ;        DELAY ROUTINE
4B5D 3AA44B   02290 DELAY    LD     A,(SPEED)
4B60 3D       02300 LOOP1    DEC    A
4B61 F5       02310          PUSH   AF
4B62 CD234A   02320          CALL   INPUT
4B65 F1       02330          POP    AF
4B66 20F6     02340          JR     NZ,LOOP1
4B68 C9       02350          RET
              02360 ;
              02370 ;FIX THE SENDING CURSOR ROUTINE
4B69 DD210050 02380 CURS     LD     IX,5000H
4B6D DD6E00   02390          LD     L,(IX+0)
4B70 DD6601   02400          LD     H,(IX+1)
4B73 77       02410          LD     (HL),A
4B74 C9       02420          RET
              02430 ;
4B75 B3       02440 TABLE    DEFB   0B3H    ; ,
4B76 FF       02450          DEFB   0FFH    ; DUMMY
4B77 95       02460          DEFB   095H    ; .
4B78 D2       02470          DEFB   0D2H    ; /
4B79 DF       02480          DEFB   0DFH    ; 0
4B7A CF       02490          DEFB   0CFH    ; 1
4B7B C7       02500          DEFB   0C7H    ; 2
4B7C C3       02510          DEFB   0C3H
4B7D C1       02520          DEFB   0C1H
4B7E C0       02530          DEFB   0C0H
4B7F D0       02540          DEFB   0D0H
4B80 D8       02550          DEFB   0D8H
4B81 DC       02560          DEFB   0DCH
4B82 DE       02570          DEFB   0DEH
4B83 FF       02580          DEFB   0FFH
4B84 FF       02590          DEFB   0FFH
4B85 FF       02600          DEFB   0FFH
4B86 FF       02610          DEFB   0FFH
4B87 FF       02620          DEFB   0FFB
4B88 8C       02630          DEFB   08CB
```

```
4B89 FF       02640          DEFB   0FFH
4B8A F9       02650          DEFB   0F9H
4B8B E0       02660          DEFB   0E0H
4B8C EA       02670          DEFB   0EAH
4B8D F4       02680          DEFB   0F4H
4B8E FC       02690          DEFB   0FCH
4B8F E2       02700          DEFB   0E2H
4B90 F6       02710          DEFB   0F6H
4B91 E0       02720          DEFB   0E0H
4B92 F8       02730          DEFB   0F0H
4B93 E7       02740          DEFB   0E7H
4B94 F5       02750          DEFB   0F5H
4B95 E4       02760          DEFB   0E4H
4B96 FB       02770          DEFB   0FBH
4B97 FA       02780          DEFB   0FAH
4B98 F7       02790          DEFB   0F7H
4B99 E6       02800          DEFB   0E6H
4B9A ED       02810          DEFB   0EDH
4B9B F2       02820          DEFB   0F2H
4B9C F8       02830          DEFB   0F0H
4B9D FD       02840          DEFB   0FDH
4B9E F1       02850          DEFB   0F1H
4B9F E1       02860          DEFB   0E1H
4BA0 F3       02870          DEFB   0F3H
4BA1 E9       02880          DEFB   0E9H    ;X
4BA2 EB       02890          DEFB   0EBH    ;Y
4BA3 EC       02900          DEFB   0ECH    ; Z
4BA4 A0       02910 SPEED    DEFB   0A0H    ;A0H=15WPM - 50H=30WPM
              02920 ;
              02930 ;KEYSCN ROUTINE
4BA5 213640   02940 KEYSCN   LD     HL,4036H
4BA8 010138   02950          LD     BC,3801H
4BAB 1600     02960          LD     D,00H
4BAD 0A       02970 CHECK    LD     A,(BC)
4BAE 5F       02980          LD     E,A
4BAF AE       02990          XOR    (HL)
4BB0 73       03000          LD     (HL),E
4BB1 A3       03010          AND    E
4BB2 2008     03020          JR     NZ,SRB
4BB4 14       03030          INC    D
4BB5 2C       03040          INC    L
4BB6 CB01     03050          RLC    C
4BB8 F2AD4B   03060          JP     P,CHECK
4BBB C9       03070          RET
4BBC 5F       03080 SRB      LD     E,A
4BBD 7A       03090          LD     A,D
4BBE 07       03100          RLCA
4BBF 07       03110          RLCA
4BC0 07       03120          RLCA
4BC1 57       03130          LD     D,A
4BC2 0E01     03140          LD     C,01H
4BC4 79       03150 AGN      LD     A,C
4BC5 A3       03160          AND    E
4BC6 2005     03170          JR     NZ,FOUND
4BC8 14       03180          INC    D
4BC9 CB01     03190          RLC    C
4BCB 18F7     03200          JR     AGN
4BCD 3A0038   03210 FOUND    LD     A,(3800H)
4BD0 47       03220          LD     B,A
4BD1 7A       03230          LD     A,D
4BD2 C640     03240          ADD    A,40H
4BD4 FE60     03250          CP     60H
4BD6 3013     03260          JR     NC,TEST
4BD8 CB08     03270          RRC    B
4BDA 3031     03280          JR     NC,SCHR
4BDC C620     03290          ADD    A,20H
4BDE 57       03300          LD     D,A
4BDF 3A4038   03310          LD     A,(3840H)
4BE2 E610     03320          AND    10H
4BE4 2820     03330          JR     Z,DLY
4BE6 7A       03340          LD     A,D
4BE7 D660     03350          SUB    60H
4BE9 1822     03360          JR     SCHR
4BEB D670     03370 TEST     SUB    70H
4BED 3010     03380          JR     NC,COMPUT
4BEF C640     03390          ADD    A,40H
4BF1 FE3C     03400          CP     3CH
4BF3 3802     03410          JR     C,SHBIT
4BF5 EE10     03420          XOR    10H
4BF7 CB08     03430 SHBIT    RRC    B
4BF9 3012     03440          JR     NC,SCHR
4BFB EE10     03450          XOR    10H
4BFD 180E     03460          JR     SCHR
4BFF 07       03470 COMPUT   RLCA
4C00 CB08     03480          RRC    B
4C02 3001     03490          JR     NC,CODE
```

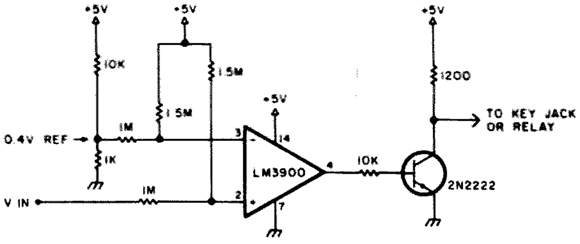

Fig. 1.

and after it appears on the screen just as you want it, press enter to store it. Up to four different messages can be stored.

When you want to send the stored message, hold the shift key and press 1, 2, 3, or 4 according to which message you want. The entire message will appear on the screen immediately after anything you have already typed in and will be sent in proper sequence when the output program gets to it.

Whenever you want to kill the output, hit the break key and you can start over.

The Program

The keyscan (02BH) subroutine in the ROM monitor contains a 17-millisecond delay. I had to rewrite this and put it in this program without that delay. Otherwise, typing in characters would mess up the output timing. Also, you will notice that I have used the keyscan subroutine as the major part of the timing loops for output of code. This is the trick that makes it appear that output and input are independent.

The output cursor is stored at 5000H and adjusted as necessary by using index addressing. The input cursor is handled by the monitor program.

The message routines were greatly simplified by making use of the subroutine in the monitor at 40H. All I had to do was put the start of the message buffer in HL. The subroutine then stores the message and

```
4C04 3C                      INC     A
4C05 215000       CODE       LD      HL,0050H
4C08 4F                      LD      C,A
4C09 0600                    LD      B,00H
4C0B 09                      ADD     HL,BC
4C0C 7E                      LD      A,(HL)
4C0D 57           SCHR       LD      D,A
4C0E 010100       DLY        LD      BC,01H
4C11 CD6000                  CALL    60H
4C14 7A                      LD      A,D
4C15 FE01                    CP      01H
4C17 C0                      RET     NZ
4C18 EF                      RST     28H
4C19 C9                      RET
                             ;
                             ;ENTER MESSAGE ROUTINE
4C1A CD2B00       MSTART     CALL    2BH              ;WAIT FOR MESS #
4C1D B7                      OR      A
4C1E 28FA                    JR      Z,MSTART
4C20 06FE                    LD      B,0FEH           ;MAX OF 254 CHARS
4C22 FE31                    CP      31H              ;MESSAGE # 1?
4C24 280F                    JR      Z,M1
4C26 FE32                    CP      32H              ;MESSAGE # 2?
4C28 281C                    JR      Z,M2
4C2A FE33                    CP      33H              ;MESSAGE # 3?
4C2C 2829                    JR      Z,M3
4C2E FE34                    CP      34H              ;MESSAGE # 4?
4C30 2836                    JR      Z,M4
4C32 C3004A                  JP      START            ;RESTART IF NO MESS #
4C35 210051       M1         LD      HL,5100H         ;M1 BUFFER
4C38 CD4000                  CALL    40H              ;INPUT MESSAGE
4C3B 78                      LD      A,B              ;GET # CRARS 1N M1
4C3C 6F                      LD      L,A
4C3D 3C                      INC     A
4C3E 320250                  LD      (5002H),A        ;STORE IT
4C41 3600                    LD      (HL),0           ;LAST BYTE 0
4C43 C3004A                  JP      START            ;M1 ENTERED
4C46 210052       M2         LD      HL,5200H         ;M2 BUFFER
4C49 CD4000                  CALL    40H              ;INPUT MESSAGE
4C4C 78                      LD      A,B              ;GET 4 CHARS IN M2
4C4D 6F                      LD      L,A
4C4E 3C                      INC     A
4C4F 320350                  LD      (5003H),A        ;STORE IT
4C52 3600                    LD      (HL),0
4C54 C3004A                  JP      START            ;M2 ENTERED
4C57 210053       M3         LD      HL,5300H
4C5A CD4000                  CALL    40H
4C5D 78                      LD      A,B
4C5E 6F                      LD      L,A
4C5F 3C                      INC     A
4C60 320450                  LD      (50B4H),A
4C63 3600                    LD      (HL),0
4C65 C3004A                  JP      START
4C68 210054       M4         LD      HL,5400H
4C6B CD4000                  CALL    40H
4C6E 78                      LD      A,B
4C6F 6F                      LD      L,A
4C70 3C                      INC     A
4C71 320550                  LD      (5005H),A
4C74 3600                    LD      (HL),0
4C76 C3004A                  JP      START
                  ;
                  ;MESSAGE SENDING ROUTINE
4C79 C5           MES1       PUSH    BC
4C7A D5                      PUSH    DE
4C7B 0600                    LD      B,0              ;FIX BC COUNTER
4C7D 3A0250                  LD      A,(5002H)        ;GET # OF CHARS
4C80 4F                      LD      C,A              ;BC=# OF CHARS
4C81 E5                      PUSH    HL               ;MAKE FRONT BUFF
4C82 D1                      POP     DE               ;THE DESTINATION
4C83 210051                  LD      HL,5100H         ;M1 BUFF SOURCE
4C86 C5                      PUSH    BC
4C87 EDB0                    LDIR                     ;MOVE IT
4C89 C1                      POP     BC               ;GET # OF CHARS
4C8A 1B                      DEC     DE               ;ADJUST BUFFER
4C8B D5                      PUSH    DE
4C8C E1                      POP     HL               ;NEW FRONT BUFF
4C8D E5                      PUSH    HL               ;SAVE IT
4C8E DD212040                LD      IX,4020H         ;CURSOR
4C92 DD5E00                  LD      E,(IX+0)         ;IS DESTINATION
4C95 DD5601                  LD      D,(IX+1)
4C98 210051                  LD      HL,5100H         ;M1 BUFF SOURCE
4C9B 0B                      DEC     BC
4C9C EDB0                    LDIR                     ;PRINT M1
4C9E DD7300                  LD      (IX+0),E         ;SAVE CURSOR
4CA1 DD7201                  LD      (IX+1),D
4CA4 E1                      POP     HL
4CA5 D1                      POP     DE
4CA6 C1                      POP     BC
4CA7 C9                      RET
4CA8 C5           MES2       PUSH    BC
4CA9 D5                      PUSH    DE
4CAA 0600                    LD      B,0
4CAC 3A0350                  LD      A,(5003H)
4CAF 4F                      LD      C,A
4CB0 E5                      PUSH    HL
4CB1 D1                      POP     DE
4CB2 210052                  LD      HL,5200H
4CB5 C5                      PUSH    BC
4CB6 EDB0                    LDIR
4CB8 C1                      POP     BC
4CB9 1B                      DEC     DE
4CBA D5                      PUSH    DE
4CBB E1                      POP     HL
4CBC E5                      PUSH    HL
4CBD DD212040                LD      IX,4020H
4CC1 DD5E00                  LD      E,(IX+0)
4CC4 DD5601                  LD      D,(IX+1)
4CC7 210052                  LD      HL,5200H
4CCA 0B                      DEC     BC
4CCB EDB0                    LDIR
4CCD DD7300                  LD      (IX+0),E
4CD0 DD7201                  LD      (IX+1),D
4CD3 E1                      POP     HL
4CD4 D1                      POP     DE
4CD5 C1                      POP     BC
4CD6 C9                      RET
4CD7 C5           MES3       PUSH    BC
4CD8 D5                      PUSH    DE
4CD9 0600                    LD      B,0
4CDB 3A0450                  LD      A,(5004H)
4CDE 4F                      LD      C,A
4CDF E5                      PUSH    HL
4CE0 D1                      POP     DE
4CE1 210053                  LD      HL,5300H
4CE4 C5                      PUSH    BC
4CE5 EDB0                    LDIR
4CE7 C1                      POP     BC
4CE8 1B                      DEC     DE
4CE9 D5                      PUSH    DE
4CEA E1                      POP     HL
4CEB E5                      PUSH    HL
4CEC DD212040                LD      IX,4020H
4CF0 DD5E00                  LD      E,(IX+0)
4CF3 DD5601                  LD      D,(IX+1)
4CF6 210053                  LD      HL,5300H
4CF9 0B                      DEC     BC
4CFA EDB0                    LDIR
4CFC DD7300                  LD      (IX+0),E
4CFF DD7201                  LD      (IX+1),D
4D02 E1                      POP     HL
4D03 D1                      POP     DE
4D04 C1                      POP     BC
4D05 C9                      RET
4D06 C5           MES4       PUSH    BC
4D07 D5                      PUSH    DE
4D08 0600                    LD      B,0
4D0A 3A0550                  LD      A,(5005H)
4D0D 4F                      LD      C,A
4D0E E5                      PUSH    HL
4D0F D1                      POP     DE
4D10 210054                  LD      HL,5400H
4D13 C5                      PUSH    BC
4D14 EDB0                    LDIR
4D16 C1                      POP     BC
4D17 1B                      DEC     DE
4D18 D5                      PUSH    DE
4D19 E1                      POP     HL
4D1A E5                      PUSH    HL
4D1B DD212040                LD      IX,4020H
4D1F DD5E00                  LD      E,(IX+0)
4D22 DD5601                  LD      D,(IX+1)
4D25 210054                  LD      HL,5400H
4D28 0B                      DEC     BC
4D29 EDB0                    LDIR
4D2B DD7300                  LD      (IX+0),E
4D2E DD7201                  LD      (IX+1),D
4D31 E1                      POP     HL
4D32 D1                      POP     DE
4D33 C1                      POP     BC
4D34 C9                      RET
4A00                         END     4A00H
00000 TOTAL ERRORS
```

prints it on the CRT; at the end, the B register contains the number of characters in the message. This is saved to use when the message is called. The value is used by the LDIR routines which transfer the message to the sending buffer and to the CRT display.

I was tempted to go back and make the program more compact. However, that would make it more difficult to understand and to modify. To add more messages, you can use the ones in the program as a guide and add to the end of the program.

Interface

A schematic of a very simple circuit is presented which can be used to interface the computer with your transmitter. The tip of the cassette auxiliary plug changes voltage from 0.4 to 0.8 whenever OUT(0FFH), A with A=1 appears. This makes it possible to use a low-voltage comparator to drive the transmitter. I measured the current in this circuit at less than 10 mA for a +5-volt supply. Any supply voltage from 4 to 36 volts can be used. Be sure to pick the two resistors in the reference voltage divider so that the reference is just slightly larger than 0.4 volts. When V in is larger than this reference, the output of the comparator goes high and turns on the transistor and this will ground its output. That will key a solid-state transmitter or a relay if you need it.

Conclusion

This program has made sending CW a real pleasure for me and I know the guy on the other end appreciates the perfectly-sent code. The computer is put into service by just plugging in the cassette auxiliary plug—the one in the middle. Correspondence always a pleasure. 73.■

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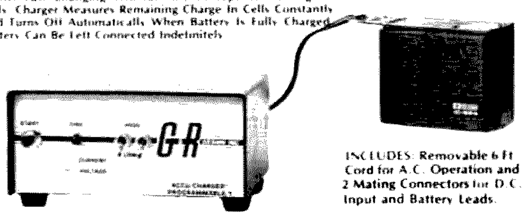

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Staff Sgt. Ed Metzler
Keesler Technical Training Center
Keesler AFB MS 39534

Thousands of hams use Morse code every day to make contact with friends and acquaintances around the world, but Morse systems operators in the Air Force use the international code for a more serious reason.

"The people we train here will go to various installations around the world, mainly to assist in communications-gathering operations," said Major Emmitt D. Lane, chief of the Systems Operations Branch at Keesler Technical Training Center, Keesler Air Force Base, Mississippi. "Our operators monitor and transcribe radio communications at many locations, providing the Air Force with a secure communications security program."

It's a critical job in today's complex, ever-changing world and it's the job of the Systems Operations Branch to see that the Air Force operators are highly qualified for their responsibilities. The branch is under the command of the 3300th Technical Training Wing, the Air Force's electronics training center. At Keesler, airmen selected for Morse systems operator duty undergo an intensive 21-week course of instruction that is divided into three blocks of instruction. Students must be able to transcribe 20 groups of code per minute to graduate from the course, although the average graduate does about 25 five-character groups a minute.

To achieve this end, students spend approximately six hours a day, five days a week in the classroom. In block I, the students are introduced to international Morse code and typing.

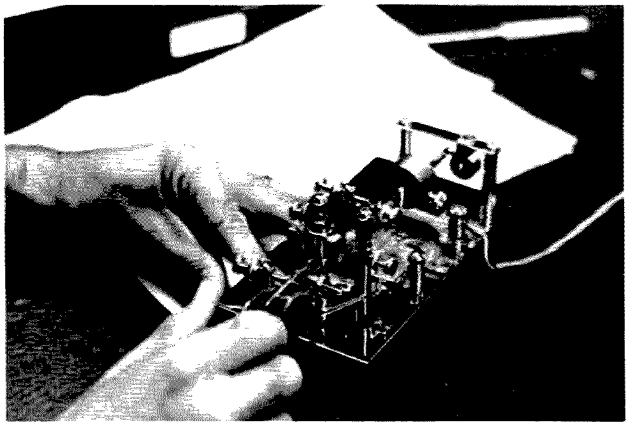
"We teach by the reflex method," said Cicero Rhodes, an instructor supervisor who spent more than 20 years in the field before retiring from active duty. "When the students hear the dahs and dits on their headphones, they automatically type the letter or number. After a lot of drill and repetition, it becomes second nature to them."

"Students learn the 31 characters during their first week of school," said Technical Sgt. Robert C. Templin, block I instructor.

Block I students are drilled on the basic characters of international Morse code.

A block I instructor uses the Vibroflex key to drill students before hooking into the distribution center.

A student in block III scans radio frequencies for message traffic.



A Vibroflex semi-automatic key used by instructors to drill students on individual characters.

"We combine learning the character sounds and typing. On day one, they learn the first finger characters as they appear on a standard typewriter, day two we teach second finger, and so on. By the end of the block, students are expected to copy 12 groups per minute."

Templin added that students who show effort, but have some difficulty learning the code, are set back in the course to bring their proficiency up. About 30 percent of the students, for one reason or another, do not graduate.

After learning the characters, the ditty-boppers, as they call themselves, work on their copy speed. As with learning the characters, this is done gradually.

"We start the classes at four groups per minute, then work up to 12," said Templin. "It's a matter of repetition and memorization." Codes are transmitted to the various classrooms by a closed-circuit system from a single distribution center. The center can send code in separate speeds to individual students or send uniform code to an entire class. The code tapes are made by the school staff, and unlike other branches of the military, are done by hand rather than computer. According to Rhodes, this personalized system allows for more individual attention.

In the basic block, students spend three to four hours a day copying messages from the distribution center. Some time is also spent in character drills. Using the Vibroflex semi-automatic key, an instructor can drill the 20 or so students in his class on particular problem characters or patterns before hooking up to the center.

In blocks II and III, students continue to increase their copying speed while learning other facets of the career field. In the intermediate block, students are taught radio wave and antenna theory and how to operate receivers. At the end of this block, students are able to copy 16 groups of code per minute. The last block deals with complex receiving using more than one receiver and locating copy on different frequencies. By the end of block III, students are expected to copy 20 groups per minute.

An instructor prepares a tape that will be used to broadcast from the distribution center.

"It's a very demanding course," said Sergeant Templin. "The material is very abstract. If someone is having trouble with a particular character, you can't just say, 'OK, turn to page 14 in the text and read all about the letter C.' It requires a person who isn't nervous or high strung, who won't get upset about every mistake he or she makes."

"Like anything else, it takes a lot of practice and patience," Rhodes emphasized. "How many tennis balls do you think you'd hit perfecting your backhand? Our methods aren't hit and miss, by any means, but I would say that repetition is the keystone to learning Morse code."

"I'm confident our methods work and that we are turning out very capable people into the field," said Major Lane. "We have to; our graduates fill some of the most critical positions in the Air Force."■

Reader Service for facing page ✓451→

SOCIAL EVENTS

MILWAUKEE WI
JUL 8-11

The YL International Single Sidebander's (YLISSB) 1982 Convention will be held on July 8-11, 1982, in Milwaukee WI. Activities will include the DX Roundup, the Systems Awards Banquet on Saturday night, and a major door prize of an Icom IC-2AT. Jean Chittenden WA2BGE will tell about her recent China trip. Pre-convention activities will begin July 5, 1982, with golfing, fishing, and side trips planned. Detailed information may be obtained by sending an SASE (business size) to Sus Musachi KB9OC, PO Box 18123, Milwaukee WI 53218.

STATE COLLEGE PA
JUL 10

The Nittany Amateur Radio Club Ham Festival will be held on July 10, 1982, from 8:00 am to 4:00 pm, at the HRB-Singer picnic grounds, Science Park Road (between US 322 West and Rte. 26 East), State College PA. Talk-in on 146.16/.76, 146.25/.85, and 146.52. Features will include a flea market, technical sessions, numerous prizes and contests, and refreshments. Tickets are $3.00; tailgating and tables are $5.00. For more information, contact Richard L. Sine KB3WN 1600 E. Branch Road, State College PA 16801.

OAK CREEK WI
JULY 10

The South Milwaukee Amateur Radio Club will hold its annual swapfest on Saturday, July 10, 1982, from 7:00 am to 5:00 pm at the American Legion Post 434, 9327 South Shepard Avenue, Oak Creek WI. Admission is $2.00 and includes a happy hour with free beverages. Prizes include a $100 first prize and a $50 second prize plus a variety of other prizes to be awarded during the day. Parking, a picnic area, hot and cold sandwiches, liquid refreshments, and overnight camping will be available. Talk-in on 146.94. More details, including a map, may be obtained from the South Milwaukee Amateur Radio Club, PO Box 102, South Milwaukee WI 53172.

MILTON ONT CAN
JUL 10

The Burlington Amateur Radio Club will hold the 8th annual Ontario Hamfest on Saturday, July 10, 1982, at the Milton Fairgrounds, Milton, Ontario. Admission is $3.00 per person or $2.00 for pre-registration. There will be a flea market, displays, an auction, contests, and prizes. Camping will be available and grounds will open Friday night for early campers. For pre-registration, contact Mike Cobb VE3MWR, PO Box 836, Burlington L7R 3Y7, Canada.

BOISSEVAIN MAN CAN
JUL 10-11

The 19th annual International Hamfest will be held on July 10-11, 1982, on the Canadian side of the International Peace Gardens between Dunseith ND and Boissevain MAN in the Canadian Pavilion. Activities will include transmitter hunts, mobile judging, CW and OLF contests, seminars for OMs and YLs, flea markets, a ham auction, a Saturday night dance, a Sunday morning breakfast, and lots of great prizes. For more information, contact Bernie Arcand WD0MD, PO Box 53, Epping ND 58843, or William M. Shryock, Jr. WD0GRC, 322 East 4th Street, Williston ND 58801.

RAPID CITY SD
JUL 10-11

The Black Hills ARC will hold the annual South Dakota Hamfest on July 10-11, 1982, at the Surbeck Center, SD School of Mines and Technology, Rapid City SD. Pre-registration is $7.00; registration at the door is $8.00. There will be a prize drawing for pre-registrants, forums, contests, a picnic, and prizes. Tables are free for the flea market. Talk-in on .34/.94 (W0BLK). For further information, write Black Hills ARC, c/o Rudy WB0PWA, 4822 Capitol, Rapid City SD 57701.

MAPLE RIDGE BC CAN
JUL 10-11

The Maple Ridge ARC will hold its Hamfest '82 on July 10-11, 1982, at the Maple Ridge Fairgrounds, located 30 miles east of Vancouver, Maple Ridge BC. Registration for hams is $5.00; for non-hams over 12 years old, $2.00. There will be food, prizes, a swap & shop, displays, a bunny hunt, ladies' and children's programs, and a main prize drawing for a Kenwood TR-2500. Camper spaces will be available (some with electrical hookups). Talk-in on 146.20/.80. For more information and registration, contact Maple Ridge ARC, Box 292, Maple Ridge BC V2X 7G2.

ALEXANDER NY
JUL 11

The Genesee Radio Amateurs, Inc., will hold the second annual ARRL-approved Batavia Hamfest on Sunday, July 11, 1982, from 7:00 am to 5:00 pm at the Alexander Firemen's Grounds, Rte. 98 (nine miles south of Batavia), Alexander NY. Registration is $2.00 in advance, $3.00 at the gate, and $1.00 for the flea market. There will be many prizes, a large exhibit area, OM and YL programs, contests, plenty of food, overnight camping, and a boat anchor auction at 3:00 pm. Talk-in on 4.71/5.31 (W2RCX) or .52. For advance tickets, make checks payable to Batavia Hamfest, c/o Gram, Inc., Box 572, Batavia NY 14020.

MCKEESPORT PA
JUL 11

The Two Rivers Amateur Radio Club, Inc., will hold its annual hamfest on July 11, 1982, from 9:00 am to 5:00 pm, at the McKeesport Campus of Penn State University, McKeesport PA. There will be forums, prizes, food, an outdoor flea market, and indoor setups. Talk-in on 146.22/.82. For more information, telephone (412)-464-0550.

INDIANAPOLIS IN
JULY 11

The Indiana State Amateur Radio Convention, in conjunction with the Indianapolis Hamfest and Computer Show, will be held on Sunday, July 11, 1982, at the Marion County Fairgrounds at the southeastern intersection of I-74 and I-465. Gate tickets are $4.00 and entitle you to all activities, including the major prize drawing and hourly prizes. There will be inside and outside flea markets, a separate computer show and flea market, a commercial vendors' display area, technical forums, club activities, and ladies' programs. There will be setups after 12:00 noon on Saturday, July 10th. Security will be provided Saturday night and Sunday, and camper hookup facilities will be available on the grounds. For further information, contact Indianapolis Hamfest, Box 11086, Indianapolis IN 46201.

MANCHESTER NH
JUL 17

The New Hampshire FM Association will hold an electronics flea market on Saturday, July 17, 1982, at the Manchester Municipal Airport, Manchester NH, beginning at 9:00 am. General admission is $1.00 per person; sellers, $5.00. Sellers should tailgate or bring their own tables. Commercial displays are welcome. Refreshments will be available and door prizes will be awarded. Talk-in on 146.52 FM and 124.9 AM. For further information, contact Dick DesRosiers W1KGZ at (603)-668-8880, or Doug Aiken K1WPM, 30 Meadowglen Drive, Manchester NH 03103, (603)-622-0831.

SHEBOYGAN WI
JUL 17

The third annual Sheboygan County Amateur Radio Club Lakeshore Swapfest and Brat Fry will be held on July 17, 1982, from 8:00 am to 4:00 pm, at the Wilson Town Hall, south of Sheboygan WI. There will be a public auction and prizes. Tables are free and camping will be available at Terry Andre State Park. For a flyer and additional information, write PO Box 895, Sheboygan WI 53081, or call (414)-457-3203.

HARBOR SPRINGS MI
JUL 17

The Straits Area Amateur Radio Club will hold its annual hamfest on July 17, 1982, from 9:00 am to 4:00 pm at the Harbor Springs High School, Harbor Springs MI. Donations are $2.00 at the door and table space is $2.50. Doors will be open at 8:00 am for setups. Lunch will be served from 11:00 am to 1:00 pm and refreshments will be available during the day. There will be one main door prize and smaller prizes will be awarded hourly. The school parking lot is free for self-contained RVs to use for an overnight stay and many places of interest to YLs are available nearby. Talk-in on .52/.52 and 146.07/.67. For more details, contact Mr. Bernie Slotnick KB8RE, 630 Ann Street, Harbor Springs MI 49740, or call (816)-526-5614.

EUGENE OR
JUL 17-18

The Lane County Ham Fair will be held on July 17-18, 1982, at the Oregon National Guard Armory, 2515 Centennial, Eugene OR. Tickets are $4.00 each and entitle the holder to one extra drawing ticket free if purchased before July 1st. Doors will open at 8:00 am Saturday and Sunday. Features will include a swap and shop at $5.00 a table, a 2-meter bunny hunt, women's activities, a children's corner, computer demos, technical seminars, QCWA, and a grand prize of an Icom 730 low-band mobile rig. There will be an all-day snack bar, free parking for RVs (no hookups), and a Saturday potluck supper at 6:00 pm. Talk-in on .52/.52, 146.28/.88, 147.86/.26, and 3.910 HF. For advance tickets, send an SASE to Eunice Brown WA7MOK, 2456 Corral Court, Springfield OR 97477, or phone (503)-747-7939.

BOWLING GREEN OH
JUL 18

The 17th annual Wood County Ham-A-Rama will be held on Sunday, July 18, 1982, at the Wood County Fairgrounds, Bowling Green OH. Gates will open at 10 am, with free admission and parking. There will be drawings for prizes; tickets are $1.50 in advance and $2.00 at the gate. Trunk sales space and food will be available. Advance table rentals are $3.00 to dealers only. Saturday setup available until 8:00 pm. K8TIH talk-in on .52. For more info or dealer rentals, send an SASE to Wood County ARC, c/o S. Irons, PO Box 73, Luckey OH 43443.

WASHINGTON MO
JUL 18

The Zero Beaters Amateur Radio Club will hold its hamfest on Sunday, July 18, 1982, at the Washington Fairgrounds, Washington MO. Talk-in on 147.84/.24. For more information, contact Rich Noelke WA0NUI, Rte. 3, 10 Richard Drive, Washington MO 63090.

CANTON OH
JUL 18

The Tusco Radio Club (W8ZX) and the Canton Amateur Radio Club (W8AL) will hold the 8th annual Hall of Fame Hamfest on July 18, 1982, at the Nimishillen Grange, 6461 Easton Street, Louisville OH. Admission is $2.50 in advance, $3.00 at the gate, and children under 16 will be admitted free. The flea market will open at 9:00 am and activities will include awards, forums, dealers, and XYL programs. Talk-in on 146.19/.79, 146.52/.52, and 147.72/.12. For reservations and/or information, contact Butch Lebold WA8SHP, 10877 Hazelview Avenue, Alliance OH 44601, or phone (216)-821-8794.

LA PORTE IN
JUL 18

The LaPorte County Summer Hamfest will be held on Sunday, July 18, 1982, at the County Fairgrounds, LaPorte IN. Good food, cold drinks, and an indoor selling area will be available. For reservations and more information, write PO Box 30, LaPorte IN 46350.

GRAND RAPIDS MN
JUL 18

The Range Wide Hamfest will be held on July 18, 1982, from 10:00 am to 4:00 pm at Gunn Park, Highway 38, 6 miles north of Grand Rapids MN. Admission and tables are free. Bring the family for a picnic, games, prizes, and fun. Parking and campgrounds will be available. Talk-in on 146.28/.88 and .52. For more information, write Bob WD0AAF, 736 Crystal Springs Road, Grand Rapids MN 55744, or call (218)-326-2268 (evenings).

OKANOGAN WA
JUL 24-25

The Okanogan Valley International Hamfest will be held July 24-25, 1982, at the Okanogan County Fairgrounds, Okanogan WA. Registration is $3.00 for hams and $2.00 for non-hams. Activities will include bingo, a cake walk, a 2-meter bunny hunt, and a Sunday potluck dinner, followed by a drawing for prizes. Talk-in on 146.97. Hookups will be available for those who need them, and motels and restaurants are close by. For more information, contact Frank Bigelow WA7ZEV or Buck Buchanon W7GSN.

OKLAHOMA CITY OK
JUL 23-25

The Central Oklahoma Radio Amateurs, Inc. will hold the Oklahoma State ARRL Convention at "Ham Holiday '82" on July 23-25, 1982, at the Myriad Convention Center, Oklahoma City OK. Pre-registration is $6.00 and includes free flea-market tables. The pre-registration award is a Radio

Shack TRS-80 color computer. Featured will be a computer fair with programs on personal computers, plus an ARRL forum, AMSAT, DX and the Art of QSLing, FM, Antennas, and Alternate Energy Sources. There will be an indoor flea market, commercial displays, a ladies' program, and on Saturday night, July 24th, the Oklahoma Diamond Jubilee Banquet followed by a western dance. The Ham Holiday Grand Award will be presented on Sunday, July 25th. For registration forms and additional information, write CORA Ham Holiday '82, PO Box 15013, Del City OK 73155.

WELLINGTON OH
JUL 24

The Northern Ohio Amateur Radio Society will hold its annual ARRL NOARSfest on Saturday, July 24, 1982, at the Lorain County Fairgrounds, 18 miles south of Lorain, one mile west of Route 58 on Route 18, Wellington OH. Admission tickets are $2.50 in advance, $3.00 at the gate, and are good for all prize drawings. Children under 12 will be admitted free. Admission tickets may be ordered from NOARSfest, PO Box 354, Lorain OH 44052. There will be over 100 prizes, including an Icom 730 and power supply, an Ameritron, Inc., A1-80 linear amplifier, and an Icom IC-2AT. Featured will be a large flea market with parking spaces at $1.00 each, free parking, an indoor exhibit hall, refreshments, and free overnight camping (without hookups) on Friday. Indoor exhibit spaces with 8-foot tables are available at $8.00 each. Send a check for advance registration to Ernie or Pat Jackson, 201 Park Avenue, Elyria OH 44035. Talk-in on 146.52/.52 and 146.10/.70.

POUGHKEEPSIE NY
JUL 24

The Mt. Beacon Amateur Radio Club will hold its annual hamfest on July 24, 1982, beginning at 8:00 am, at the Arlington Senior High School, Poughkeepsie NY. Admission is $2.00 (XYLs and children admitted free), tailgating space is $3.00 (includes 1 free admission), and a table space is $4.00 (includes 1 free table and admission). There will be the free flea market tables indoors, parking door prizes, an auction starting at 2:00 pm, and hot food and beverages. Talk-in on 146.37/.97 and 146.52. For additional information, advance tickets, or registration, send an SASE to Walt Cotter WA2ZCN, North Hillside Lake Road, Wappingers Falls NY 12590, or phone (914)-226-6636.

GREENVILLE OH
JUL 24-25

The Treaty City Amateur Radio Association will be operating special event station W8UMD from the site of the Annie Oakley Days celebration, from 1600Z July 24 until 1600Z July 25. They will operate up 10 kHz from the bottom of the General band on 40 and 20 meters and will venture into the 40-meter Novice band occasionally. Send a business size SASE and QSL cards for a special certificate to TCARA, Box 91, Greenville OH 45331.

WEST FRIENDSHIP MD
JUL 25

The Baltimore Radio Amateur Television Society (BRATS) will hold its annual BRATS Maryland Hamfest on Sunday, July 25, 1982, at the Howard County Fairgrounds, Route 144 at Route 32, adjacent to Interstate 70, about 15 miles west of Baltimore, in West Friendship MD. Indoor tables with ac power are $15.00 each; without ac power, $10.00 each. Indoor tailgating is $5.00 per space; outdoor tailgating is $3.00 per space. Overnight RV hookups will be available. For more information and reservations, write to BRATS, PO Box 5915, Baltimore MD 21208.

CENTREVILLE MI
JUL 25

The Amateur Radio Public Service Association of St. Joseph County MI will hold its 4th annual swap and shop on July 25, 1982, at the St. Joseph County Fairgrounds, Centreville MI. Doors open at 8:00 am. Tickets are $2.00 in advance and $3.00 at the gate. Indoor tables are $2.00. Trunk sales are free. Camping is available Saturday night only for $6.00. Talk-in on 146.52. For more information, contact Dennis Cutler N8DDU, 3051 Z Avenue, Vickesburg MI 49097.

WHEELING WV
JUL 25

The Triple States Radio Amateur Club will hold its 4th annual hamfest on Sunday, July 25, 1982, from 9:00 am to 4:00 pm, at Wheeling Park, Wheeling WV. Admission is $2.00 (50/50); children under 12 will be admitted free. There will be major prizes plus door prizes every 15 minutes; a 15-minute auction every hour on the hour; free parking for 1,000 cars; refreshments; ARRL/SWOT/TSRAC booths; indoor dealer displays; and a flea market. There will be setups the night before or at 7:00 am Sunday morning. Talk-in on 146.31/.91 and 146.52. For advance dealer registration, electrical outlet and table requests, submission of free ads for the club's hamfest issue, and more information, contact TSRAC, Box 240, RD 2, Adena OH 43901.

NEW ORLEANS LA
JUL 25

The Delgado Community College Amateur Radio Club will hold its annual swapfest on Sunday, July 25, 1982, from 8:00 am to 4:00 pm, at the Peristyle in City Park, New Orleans LA. There is no charge for setting up, but those participating must bring their own tables. Admission is free. There will be plenty of free parking, and food and drinks will be available nearby. Talk-in on 146.67. For further information, contact Jim Wolfe, Club President, Delgado Amateur Radio Club, Delgado Community College, 615

Continued on page 150

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RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

I somehow find it hard to believe, but this column marks the beginning of the sixth year of RTTY Loop! Back in 1977, when I started this column in a local club newsletter, the most exotic item I was asked about was the Teletype® Model 28, or occasionally the Model 33. Now, in just a half-dozen years, the bulk of the questions concern adapting any of the myriad of personal computers to RTTY.

Many readers, having sensed my affection for the Motorola 6800 series of computers, have asked about programs directed towards that line. In the past, I have featured quite a few individual programs which allow receiving or transmitting RTTY on a 6800 system. One feature often requested, and certainly available on many commercial RTTY terminals, is the so-called "split-screen" capability. This is the display of both the received signal and transmit buffer on the screen at the same time.

Let's take a look at what such a program requires, and over the next few sessions see if we can develop a reasonable technique for implementing a split-screen RTTY terminal. In doing this, I will try to keep within my design philosophy, which is: If it can be done in software, do it. While this sometimes increases the complexity of the written code, I believe that in the long run working out a logical software solution to problems provides both a straightforward method of problem-solving and a cost-effective approach for the ham on a budget.

The first step will be to define what this terminal will need to do. Let's require only the ability to handle 60-wpm Murray (Baudot) code; other speeds will not be hard to add, and a given code set will keep things simple for the time being. I would like the top half of the screen to display the received signal, with the most recent lines being maintained, and the bottom half to show the transmit buffer. You should be able to fill the transmit buffer while receiving and continue to add to it even while transmitting.

I am going to have to be rather specific on the hardware requirements. We will be writing for a Motorola 6800-based computer, with the I/O block located at $8000, using the old "SWTPC" standards. A video-mapped display will be a must. Users of "smart" terminals, such as the Soroco IQ-120, can position the cursor anywhere using escape sequences, and this could be used to implement a split-screen display. However, in order to selectively scroll the screen, manipulation of data will be required directly, and this will necessitate the type of access a video board allows. While I will be writing for a GIMIX board, the program should be general enough to allow any of the popular video displays to work.

Now, on to the program. In the past, I have received some letters critical of my rapid entry into source codes. It seems that all of you are not as comfortable as I in the realm of LDAA and CPX instructions. I therefore shall wade in from the shallow end, although I prefer diving right in. Let's start by looking at the logic involved for this program.

Well, not just yet. You see, that's been another criticism. Flowcharts, those indispensable tools of the computer programmer, are just so much gobbledygook to a good number of you. I have, in the past, presented several flowcharts without much in the way of background. I shall attempt to rectify this omission herewith.

A flowchart is a map, diagram, or skeleton of a computer program, depending on how you look at it. Let's take a rather simple example. I say something like, "Take a number and call it A. Is it greater than 10? If so, print an H. If not, print an L. Now do it again." This sequence defines a logic sequence. Many of you familiar with BASIC, the rather universal higher-level language used in personal computers, could write rather rapidly from this description the program shown in Fig. 1. This would be one way to accomplish the task. Another is shown in Fig. 2, which is a 6800 assembly-language implementation of the same simple-minded job. I think you can see that there is quite a difference, and can imagine further differences when the process is extended to 6502-, 8080-, Z-80-, Pascal-, FORTRAN-, or APL-speaking computers. What is needed is some universal way to represent the logic sequence. That is the flowchart.

Steps in a flowchart are represented by boxes, each of which contains one logical process. This process may be a simple one-byte instruction or an entire subroutine. It doesn't matter, so long as it can be visualized as a unit. Different shaped boxes are frequently used to represent different types of processes. Three of those are shown in Fig. 3, with their definitions. There are many others, but these three will suffice for this month's flowchart.

```
0010 INPUT "TYPE A NUMBER",A
0020 IF A>10 GOTO 50
0030 PRINT "L"
0040 GOTO 10
0050 PRINT "H"
0060 GOTO 10
```

Fig. 1.

```
START JSR  INPUT
      CMPA 10
      BGT  HIGH
      LDAA 'L
      JSR  OUTPUT
      BRA  START
HIGH  LDAA 'H
      JSR  OUTPUT
      BRA  START
```

Fig. 2.

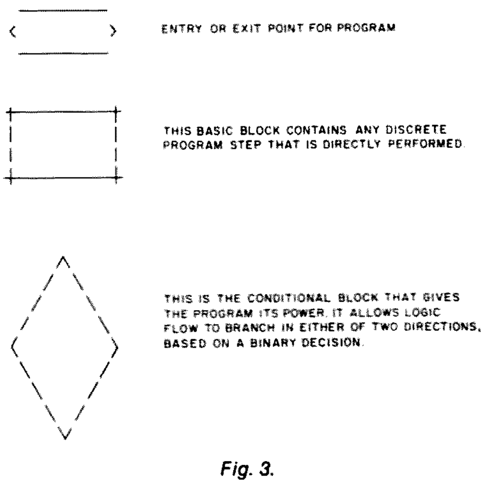


Fig. 3.

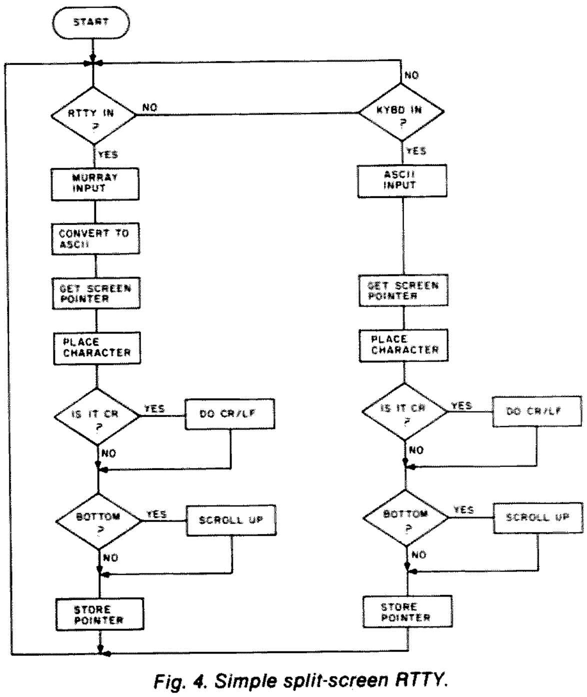


Fig. 4. Simple split-screen RTTY.

The boxes are connected by lines, through which logic flow is presumed to flow in a top-to-bottom, right-to-left direction. If flow is contrary to these directions, arrows are used to define such progression.

With this under our belts, let's take a look at the flowchart in Fig. 4. Entering at START, we immediately come to a decision. If there is a bit on the RTTY input pin, then a character is about to come in. If not, the local keyboard can be checked for input. If no data is found there, the program returns to check the RTTY once again and the loop continues.

If a character has been typed on the local keyboard, it is inserted into a buffer and displayed on the lower half of the screen. Later on, we will add some checking for special characters which will control the program or other features. For now, let's just be happy to fill the buffer.

Received RTTY characters are also stuffed onto the screen, but on the top half. During receipt of the RTTY character, however, there is quite a bit of time when the computer would be idling, waiting for these long, 21-ms pauses to go by. During these pauses, as shown in Fig. 5, the keyboard is checked once again. Input is allowed here, too, and again placed on the screen and stuffed into the buffer.

All this inputting and buffering requires a raft of pointers and protocols. Placing a character on the screen will require pulling a set of pointers from storage, placing the character on the screen, updating the pointers, checking to see if a new line must be started, and possibly scrolling that segment of the display. And all this must be accomplished within the wink of an eye.

Now that we have the road map, let's begin our journey. The program we will use is an implementation of an output routine which will serve as the window into the RTTY terminal we will be building. Before I go into the ins and outs of the program itself, maybe I'd better explain some of the rather peculiar GIMIX system function calls.

Like most operating systems, the GMXBUG monitor features a variety of routines which may be used to input or output characters or manipulate data in various ways. Unlike most, which use subroutine calls to access such routines (JSR ADDR or $BD $nnnn), GMXBUG provides for the use of the software interrupt (SWI or $3F) instruction to create a set of two-byte pseudocodes. In the typical sense, one may write the code $3F $10 to input a character, for example, rather than the MIKBUG style $BD $E1AC (JSR INEEE).

Moreover, GMXBUG features several routines not offered in other 6800 monitors, many of which demonstrate a high level of utility. While these routines may be written in for systems based on another monitor, as long as they are here, why not use them? In order to allow the assembler to handle these two-byte pseudocodes, I write them as double-byte data statements (FDB) and call them as such.

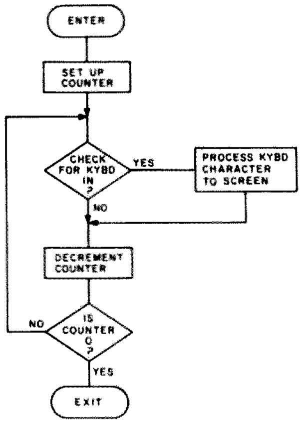


Fig. 5. Murray input delay routine.

```
                       NAM   HALF SCREEN TEST
                ******************************
                * DEMONSTRATION ROUTINE TO *
                * OUTPUT ON THE LOWER HALF *
                *       OF A GIMIX VDM       *
                *     VERSION 1.00 - FOR     *
                *  RTTY LOOP : JULY, 1982  *
                *    MARC I. LEAVEY, M.D.    *
                ******************************
                       OPT   NOS,NOG
                *
                * GIMIX FUNCTION CALLS
                *
3F04            ADDAX  EQU   $3F04      Add ACCA to INDEX
3F06            SUBAX  EQU   $3F06      Subtract ACCA from INDEX
3F0E            MOVER  EQU   $3F0E      Block Move Routine
3F11            OUTCHR EQU   $3F11      Normal character output
A002            BEGIN1 EQU   $A002      Lower bound for move
A004            END1   EQU   $A004      Upper bound for move
A014            BEGIN2 EQU   $A014      Lower bound to go to
                *
                * ENTRY POINT
                *
A800                   ORG   $A800      Unused in my system
A800 81 0D      HAFSCR CMP A #$0D       Is it CR?
A802 27 15             BEQ   DOCR
A804 81 0A             CMP A #$0A       Is it LF?
A806 27 14             BEQ   DOLF
A808 81 07             CMP A #$07       Is it BELL?
A80A 27 13             BEQ   DOBELL
A80C 81 0C             CMP A #$0C       Is it FF?
A80E 27 12             BEQ   DOFF
A810 81 08             CMP A #$08       Is it BS?
A812 27 11             BEQ   DOBS
A814 81 20             CMP A #$20       Is it a Control Char?
A816 2C 10             BGE   PRINT
A818 39         HAFXIT RTS
                *
A819 7E A846    DOCR   JMP   CARRET     * Jumps to
A81C 7E A855    DOLF   JMP   LINFED     * wherever called
A81F 7E A894    DOBELL JMP   BELL       * for by the
A822 7E A897    DOFF   JMP   FRMFED     * control
A825 7E A8B1    DOBS   JMP   BAKSPC     * character
                *
A828 FE A8C6    PRINT  LDX   LOCATE     Get spot for char
A82B A7 00             STA A X          Put char there
A82D 08                INX
A82E FF A8C6           STX   LOCATE     Save next spot
A831 F6 A8CC           LDA B COUNT      Get line char count
A834 5C                INC B
A835 F7 A8CC           STA B COUNT
A838 F1 A8CD           CMP B ENDLIN     Is line full?
A83B 27 01             BEQ   NEWLIN     Yes, do CR/LF
A83D 39         PEXIT  RTS
                *
A83E BD A846    NEWLIN JSR   CARRET     So do CR
A841 BD A855           JSR   LINFED     and LF
A844 20 F7             BRA   PEXIT      then exit
                *
                *
A846 FE A8C6    CARRET LDX   LOCATE     Get current locale
A849 B6 A8CC           LDA A COUNT      And current nr of chars
A84C 3F 06             FDB   SUBAX      Subtract the two
A84E FF A8C6           STX   LOCATE     Store that
A851 7F A8CC           CLR   COUNT      Clear char count
A854 39         CARXIT RTS
                *
                *
A855 B6 A8D0    LINFED LDA A ROWNR      Get current row nr
A858 B1 A8CF           CMP A HIROW      Are we at bottom?
A85B 27 10             BEQ   SCROLL     Yes... do a scroll
A85D 4C                INC A            No, just a line feed
A85E B7 A8D0           STA A ROWNR      Store new row
A861 FE A8C6           LDX   LOCATE     Get old location
A864 86 50             LDA A #80
A866 3F 04             FDB   ADDAX      Add 80 to locale
A868 FF A8C6           STX   LOCATE     And replace old data
A86B 20 26             BRA   LFEXIT     Then exit
A86D FE A8C8    SCROLL LDX   BGNVDM     A scroll! First set up
A870 FF A014           STX   BEGIN2     vectors for MOVER
A873 86 50             LDA A #80        80 + BGNVDM
A875 3F 04             FDB   ADDAX      equals start of 2nd line
A877 FF A002           STX   BEGIN1
A87A FE A8CA           LDX   ENDVDM
A87D FF A004           STX   END1
A880 3F 0E             FDB   MOVER      Block move text up 1 line
A882 FE A8CA           LDX   ENDVDM     Find end of screen
A885 86 50             LDA A #80
A887 3F 06             FDB   SUBAX      Go back 80
A889 86 20             LDA A #$20       Then fill
A88B A7 00      SCLOOP STA A X          from there to
A88D 08                INX              the end with
A88E BC A8CA           CPX   ENDVDM     spaces
A891 26 FB             BNE   SCLOOP
A893 39         LFEXIT RTS              Exit when done
                *
                *
A894 3F 11      BELL   FDB   OUTCHR     Just send the BELL out the
A896 39                RTS              old fashioned way!
                *
                *
A897 FE A8C8    FRMFED LDX   BGNVDM     Make the beginning the
A89A FF A8C6           STX   LOCATE     current location
A89D 7F A8CC           CLR   COUNT      Counter = 0
A8A0 B6 A8CE           LDA A LOROW      and reset the
A8A3 B7 A8D0           STA A ROWNR      row counter
A8A6 86 20             LDA A #$20       Take a space
A8A8 A7 00      FFLOOP STA A X          store it at index
A8AA 08                INX              increment across the screen
A8AB BC A8CA           CPX   ENDVDM     Are we at end?
A8AE 26 FB             BNE   FFLOOP     No, keep it up
A8B0 39         FFEXIT RTS              Otherwise, exit
                *
                *
A8B1 F6 A8CC    BAKSPC LDA B COUNT      If the char count is 0
A8B4 27 0F             BEQ   BSEXIT     just exit
A8B6 5A                DEC B            Otherwise decrement the count
A8B7 F7 A8CC           STA B COUNT      and store it
A8BA FE A8C6           LDX   LOCATE     Get the location vector
A8BD 09                DEX              decrement that
A8BE 86 20             LDA A #$20       Then stick a space
A8C0 A7 00             STA A X          there
A8C2 FF A8C6           STX   LOCATE     then store the vector
A8C5 39         BSEXIT RTS              and we are done
                *
                *
A8C6 F4 10      LOCATE FDB   $F410      Address of next char
A8C8 F4 10      BGNVDM FDB   $F410      Start of VDM
A8CA F7 7F      ENDVDM FDB   $F77F      End of VDM
A8CC 00         COUNT  FCB   0          Current char count
A8CD 50         ENDLIN FCB   80         Char's per line
A8CE 0D         LOROW  FCB   13         Nr of lowest row
A8CF 17         HIROW  FCB   23         Nr of highest row
A8D0 0D         ROWNR  FCB   13         Current row
                *
                *
                       END
     NO ERROR(S) DETECTED
```

Fig. 6.

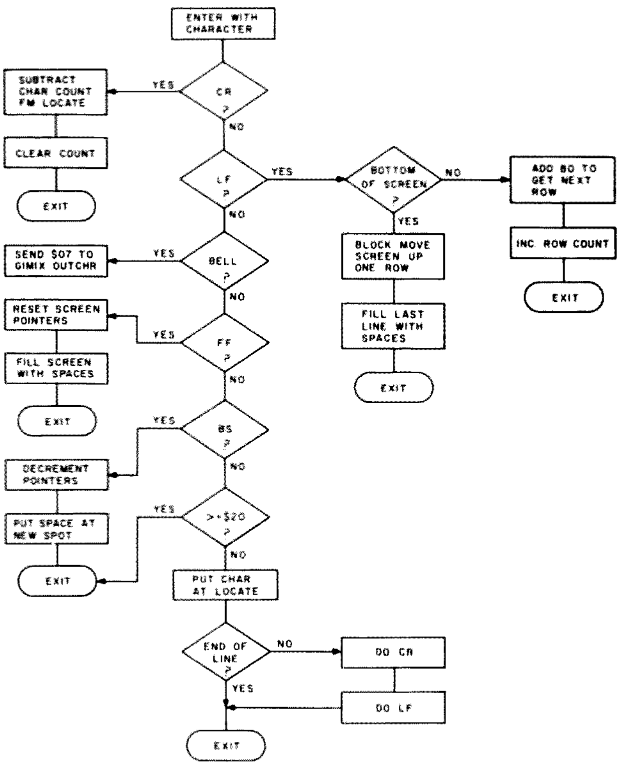


Fig. 7.

Routines used in this month's program include:

ADDAX ($3F04)—Adds the contents of accumulator A to the contents of the index register and places the result in the index register. The addition is unsigned. The former contents of the index register are lost.

SUBAC ($3F06)—Subtracts the contents of accumulator A from the contents of the index register and places the result in the index register. The subtraction is unsigned. The former contents of the Index register are lost.

MOVER ($3FOE)—A general purpose block-mover routine. Moves the contents of memory starting at the address in BEGIN1 ($A002) through the address in END1 ($A004) inclusive to memory starting at the address in BEGIN2 ($A014). Checks for overlap of source and destination areas. If necessary, the move Is done back-to-front.

OUTCHR ($3F11)—Conventional character output to the video-driver routines of the ASCII character contained in the A accumulator.

Enough background? OK, let's see how we can chop a screen in half. The listing in Fig. 6 is a demonstration program to do this. The flowchart in Fig. 7 can be followed step by step, to see how the listing was developed.

To begin with, we shall recognize that certain non-printing characters are useful, so let's screen for them. A carriage return, line feed, bell, form feed, and backspace, each in turn is checked for. Should any of them be found, a branch to a corresponding routine is done, and we will cover those later. Any other control character we will ignore for now.

The handling of printing characters is straightforward. The address of the next character to be printed is stored at a spot we will call "LOCATE." So, we get that address, place the character there, increment to the next spot, and store it. Now, a line counter, call It "COUNT," is incremented to see where on the line we are. If at the end, calls to the carriage-return and line-feed routines initiate a new line. Which routines are these? Why, the same routines that a carriage return and line feed call up, no? Yes! And I bet you thought this was going to be complicated.

Now let's take a look at some of those special routines. What's that I hear? OK, carriage return, you first. What is a carriage return after all? A resetting to zero on the current line, that's all. So, to implement a carriage return, first we load the current location into the index register, then the character count (where on the line are we?) into the A accumulator. Subtract the two, using that SUBAX routine, and you have the beginning of the line. Store that as the new location, clear the line count itself, and the carriage return is done.

Line feed? No, let me save you for last. How about something easy, like the bell. This nonprinting character rings a software bell in the GIMIX system. So let's just send it out through the regular character output. Well, so much for that one.

The form feed is used to clear the screen, and it is a neat character; let's see why. First, we set the character location to the first one in the screen sector, clear the character count and set the row counter to the first row. Next a loop is entered to load the entire screen window with spaces ($20). When that's done, the screen is reset and clear.

Backspace is also not so hard. For now, let's prohibit backspacing past the beginning of the line up onto the previous line. So, we check the character counter and If it's zero we don't backspace. If it's OK, just decrement the count, store it, decrement the location, store it, and put a space where we are now. Like I said, not so hard.

OK gang, time to roll up our sleeves and look at the line feed. If we take it one step at a time, it shouldn't be too hard. We have been keeping track of current row on the screen, as well as character position on the line. So first we must check the row counter and, if the current row is the last on the screen, initiate a scroll. Hang onto that one for a second. If not a scroll, it is easy. With eighty characters per line, adding eighty to the current location gives the corresponding spot on the line below. Increment the row number, add eighty to the location, store all this new data, and we are done.

Now, about that scroll, let's look. First, we find the start of the second screen line; this will become the top line after the scroll. This address is stored in BEGIN1 for use by the MOVER routine. The end of the screen defines END1, and the data on display is shifted up one line. Now one more task needs to be taken care of. The last line on the screen is filled with spaces, clearing it for new data.

Note, by the way, that the carriage return does not initiate a scroll, nor does a line feed reset position within a line. It takes both!

The data and storage needed for the program is situated at the end of the instructions. I've got to indicate here that there is nothing sacred about using the bottom thirteen lines, as shown here, or the whole eighty characters across. Change it to the middle sixteen lines with thirty-two characters if you are nostalgic. Versions of this same routine will be used for several windows in the RTTY terminal which we will be building up.

As time goes on, we will continue to develop the routines needed, one by one, for this full-featured RTTY terminal. Next month, though, I'll take a crack at some of the mail from readers which has been piling up on my desk. That and more, In RTTY Loop to come.

HAM HELP

I need manuals and/or schematics for the following:

- SG92 A/U rf sweep generator
- Nems Clarke receiver 2501B
- Nems Clarke signal display SDU 350-9
- Nems Clarke Range Extender REU 300B
- Tektronix Model 564 (early model) oscilloscope mainframe

I will pay reasonable costs for copying and postage.

Bruce Owings WA4BPV
2483 Gwinn Drive
Norcross GA 30071

I'm looking for info on converting the Icom 22S to the new 20-kHz band plan.

Joe Ciskowski
Rt. 1, Box 558
Bonners Ferry ID 83805

TVRO: Georgia Style

—one man's junk is another man's antenna

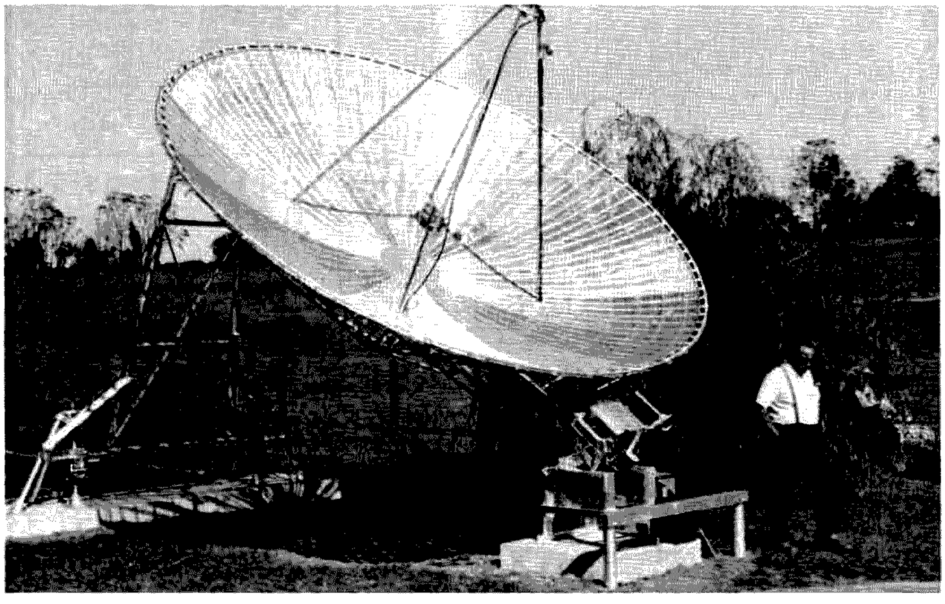
Timothy Daniel N8RK
73 Magazine Staff

This is not the typical *73* construction article. Herman "Tex" Friedsam's satellite TV antenna is not offered in kit form, nor are a complete set of plans available.

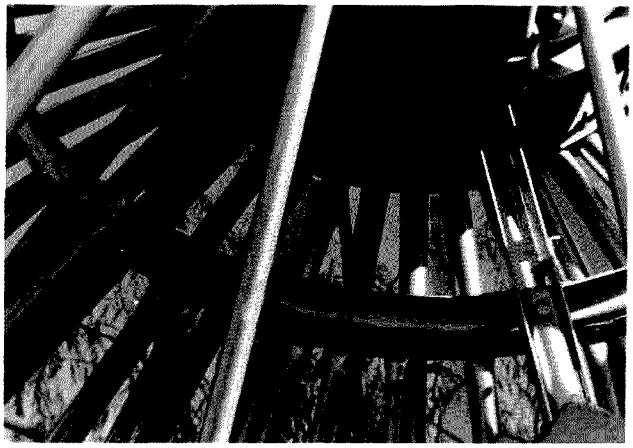
Just in case you still want to give this project a try, here are some of the parts you will need: the magnesium bell housing for a helicopter's propeller, one line shaft from a cotton gin, and don't forget the swivel-type hitch from a cultivator. With those items acquired, it is time to continue the search, this time looking for a worm gear reducer (Tex salvaged his from a brick factory's conveyor); you'll also need a frame for the drive mechanism—try the local hammer mill.

What may sound like a hopelessly incompatible pile of junk has become an engineering masterpiece in the small town of Marshallville, Georgia. Tex, whose ham call is WA4OPY, approached this project like he does most things. Using his experience as a textile plant engineer, he started with an idea but not a plan. After collecting several of the key components, he settled on a design for a 15.27888-foot-diameter parabolic reflector. The 18 hours of research and planning were among the project's easiest work. Construction of the frame, which began in the spring of 1979, took almost 200 hours. Realizing that painstaking accuracy results in a better picture when you are done, Tex and a friend each spent 12 hours making a plywood template of the antenna's curved surface. Two thousand feet of electrical conduit and PVC pipe later, the frame was ready to cover with aluminum screen. The basic dish, when completed, weighed only 425 pounds.

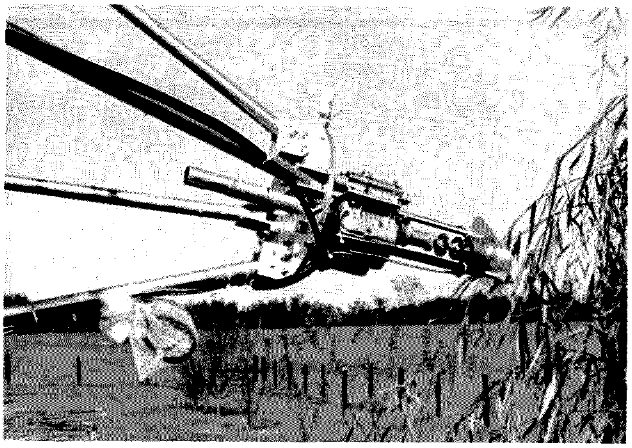
Tex's research pointed out the imperfections of the polar mount, the traditional way a dish scans the hori-



Tex WA4OPY with his home-brew dish.



The antenna's hub is constructed around a helicopter's propeller bell housing. An octagonal frame, eight feet in diameter, extends outward, supporting the antenna's surface.



The feed assembly allows the horn polarization to be changed via a TV rotor and there is provision for very fine adjustments of the horn location. This allows the receive signal to be maximized.

zon. By building a frame that could be moved horizontally as well as in a polar arc, the WA4OPY antenna can be accurately positioned with a minimum of fudging. The major supporting axis is the only part of the system fabricated by an outsider. A 1/2-horsepower motor used to turn the dish is the only component that was purchased new. The rest of the parts were salvaged from local scrap piles. Being the owner of a hardware and variety store didn't hurt, nor did Tex mind using "scrap" from his brother-in-law's grain mill.

Patience seems to be the main rule behind this project. When it came time to fine-tune the antenna's surface, Tex spent 61 hours, much of it with a flashlight and a piece of shiny aluminum. When he was finished, the dish's focal point was no bigger than a nickel. As Tex got around to building a feed assembly, he decided that there was nothing suitable on the commercial market, so he designed his own. It worked so well that he has started to manufacture them for other hobbyists.

By April of 1981, almost two years after he started construction, Tex was ready to give his system a try. The electronics, like the antenna, were home-built. The first pictures, in Tex's words, were "lousy images of a Snoopy cartoon." Today, "lousy" pictures have been replaced by clear reception and satellite television has become part of the Friedsam family life. The receiver has been built into an attractive piece of living room furniture and the dish, which sits across the driveway, moves somewhat mysteriously by remote control.

Tex carefully documented the construction of his system, keeping track of the materials and time he used. For instance, 1700 3/8-inch sheet-metal screws were needed to apply the aluminum screening, and it took 29 hours to install a shielded underground cable between the house and the dish.

Along the way there were many sources of frustration; for example, the frame broke when it was ninety percent complete. Tuning up the microwave circuitry required a signal generator that none of the local scrap piles could offer. Tex built his own, using a klystron tube.

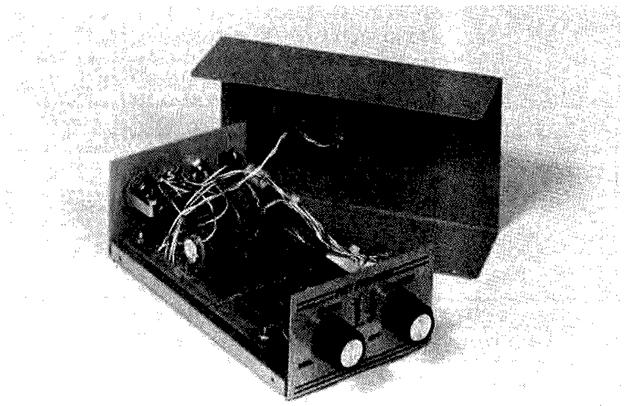
Perhaps the most impressive fact concerning Tex's accomplishment was that he had never seen a TVRO installation and he had never been within a mile of a large parabolic antenna. Working from theory and the scrap piles of Marshallville, Georgia, he has built a functional monument to the home-brew spirit of radio. ■

The dish, which is almost 16 feet in diameter, has a frame built from PVC pipe and electrical conduit. The supporting bar, which spans the dish, is the only piece that Tex did not fabricate himself.

NEW PRODUCTS

STRAIGHT-KEY KEYER

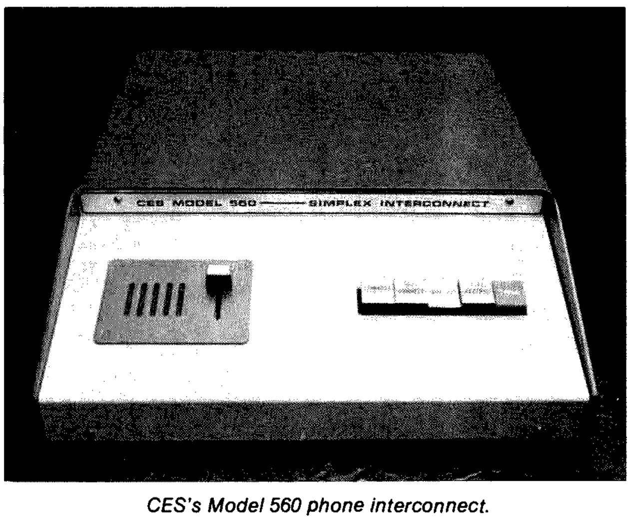
Designed exclusively for straight-key users, the Fist Fighter is an electronic keyer that accurately times the length of dots, dashes, and the spaces between them. The Fist Fighter uses a standard 1:3:1 timing ratio and requires no new hand motions. An automatic tune-up feature is built in so that normal key-down tune-up is possible, without the need for any extra switches. Speed is variable from about 3 to 30 wpm. The Fist Fighter will key grid-block and solid-state transmitters/transceivers. It is available in two forms: kits cost $59.95 and an assembled version sells for $79.95. Additional information and specifications are available from *The Blacksburg Group, Box 242, Blacksburg VA 24060.* Reader Service number 482.


The Fist Fighter.

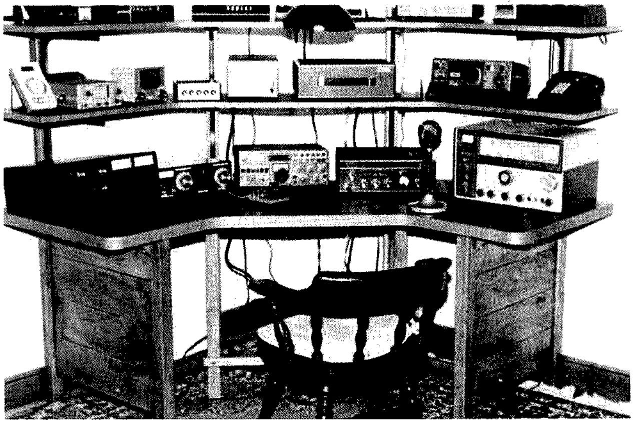
PHONE INTERCONNECT

The CES Model 560 interconnect is designed to interconnect a base station or control station to a telephone line. The 560 is a sampling type of interconnect, using no VOX circuits for control. The Model 560 is one way that repeaters located away from phone lines can have autopatch capability. When the interconnect is in use, the control station will transmit for one second and then sample the receiver for ten to twenty-five milliseconds to determine if a station is transmitting. If a signal is found, the control station will stay on receive until it stops; if no signal is present, the control station will transmit for another second.

Toll-restrict and dial-out capability can be enabled by front-panel switches. The Model 560 does not affect the use of the control station for normal communication. It is priced at $990. For more information, contact *Communications Electronics Specialties, Inc., PO Box 507, Winter Park FL 32790.* Reader Service number 478.



CES's Model 560 phone interconnect.


CQ Products' operating desk.

SHACK FURNITURE

CQ Products announces the introduction of an operator's desk designed like an organ console to place all the operator's equipment within easy view and reach. The desk surface and shelves are constructed of 200-pound industrial-grade chipboard and are covered with formica. The two shelves are adjustable in height to accommodate virtually any ham or computer gear.

The desk is designed to fit into the corner of your ham shack and is also attractive enough to be placed in your living room or den. The desk occupies 60 inches from the room corner to each edge. It is priced at $495. For more information, contact *CQ Products, 8280 Janes Avenue, Suite 137-1700, Woodridge IL 60517.* Reader Service number 476.

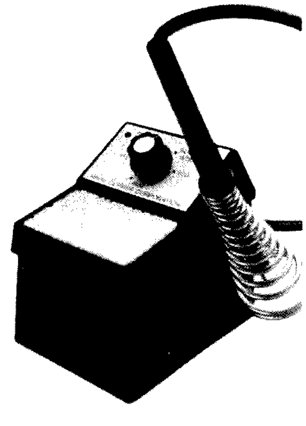
MICRO SOLDERING STATION

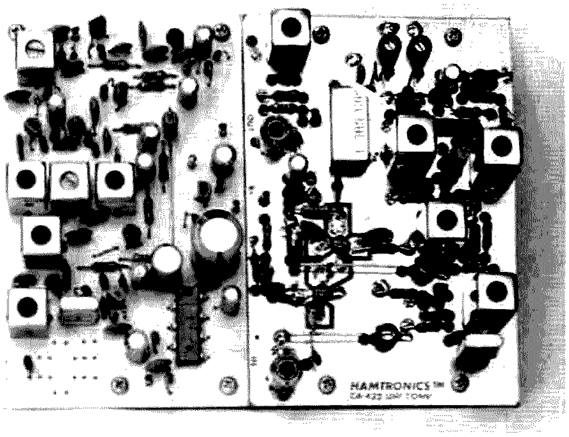
The Wahl Clipper Iso-Tip 7470 micro soldering station eliminates continuous switching to maintain temperature and, therefore, the spikes that can damage delicate electrical components. The totally grounded unit can be adjusted for any temperature between 500 and 700 degrees F. With the selection of the proper tip, heat is delivered only to those points where it is needed. The temperature-adjustable soldering station comes complete with sponge holder, tip-wiping sponge, soldering iron, and stand. The suggested price is $47.75. For further information, contact *Wahl Clipper Corp., PO Box 578, Sterling IL 61081.* Reader Service number 479.

VHF KITS

The R76 VHF FM receiver kit is an improved version of the R75 receiver for 10m, 6m, 2m, 220 MHz, or the adjacent commercial bands. It features a very low-noise front end, pump-resistant squelch with hysteresis to lock onto fading signals, onboard volume and squelch controls for easy wiring, and fixed i-f filters for easy alignment. It is available in two selectivity options, starting at $84.95.

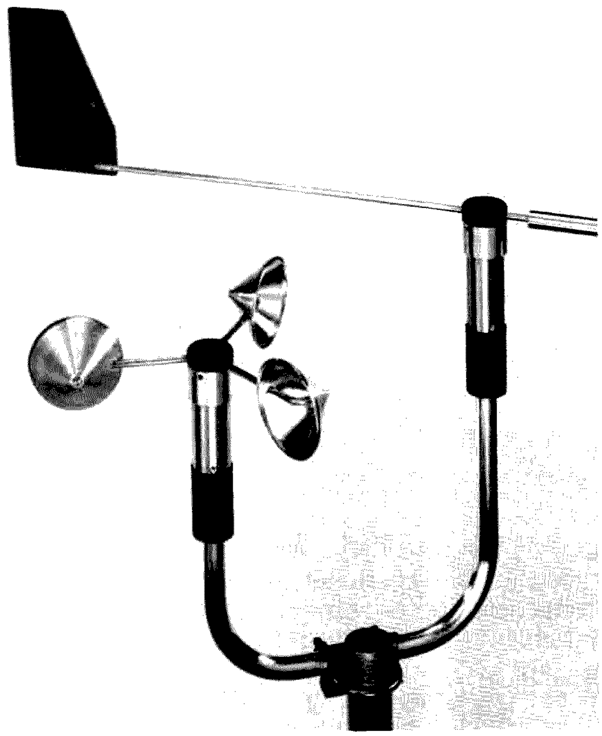
A new UHF receiver kit has also been introduced. The

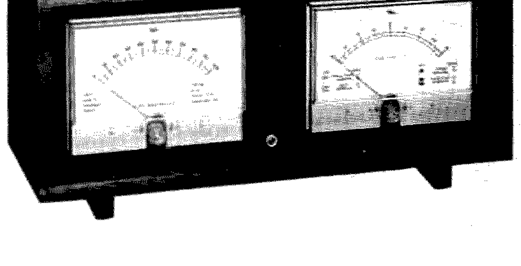

Wahl's Iso-Tip 7470 micro soldering station.



Hamtronics' Shuttle receiver.

Palomar Engineers' PT-407 antenna tuner.





TMAC Products' S.D.-500 weather station.

model R451 includes the features listed above plus automatic frequency control to lock onto drifting transmit signals. Kits are available with various options starting at $94.95.

Hamtronics has a new line of low-noise amplifiers. In appearance, they resemble Hamtronics' earlier P30 and P432 receiver preamplifiers, but the circuit is new. They are optimized for lowest noise figure in the ham bands but can also be used on adjacent commercial bands. Noise figures typically run 0.5 dB at 28 and 50 MHz, 0.6 dB at 144 MHz, 0.7 dB at 220 MHz, and 0.95 dB at 432 MHz. Gain runs from 33 dB at 28 and 50 MHz to 17 dB at 432 MHz.The price is $39.95 for the VHF units and $44.95 for the UHF unit, all wired and tested.

The Hamtronics R110-450 UHF AM aircraft receiver may be used to listen to the Space Shuttle. Good results have been reported using simple UHF antennas. The special Shuttle receiver kit is available off the shelf for $94.95.

For further information on these products, write to *Hamtronics, Inc., 65-V Moul Road, Hilton NY 14468; (716)-392-9430.* Reader Service number 480.

WEATHER STATION

TMAC Products is introducing the S.D.-500 weather station. This system provides wind velocity indications from 0-100 mph and wind direction readings covering 16 compass points. The console is constructed of hand-finished mahogany and the transmitter can be up to 300 feet away from the console and a 50-foot cable is supplied. The unit is powered by 155 volts ac. The list price is $360. For more information, contact *TMAC Products, PO Box 28341, Columbus OH 43228.* Reader Service number 483.

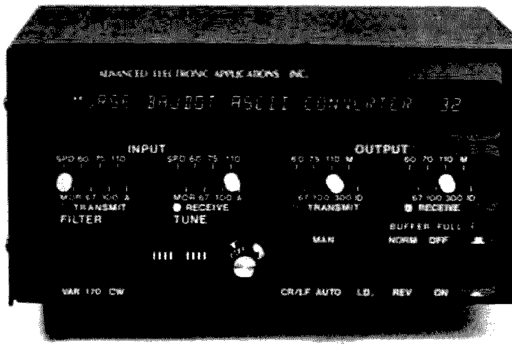
ANTENNA TUNER

The Palomar Engineers PT-407 is a general-purpose tuner for 1.8-30 MHz to match antennas fed with coaxial or open-wire lines, single-wire or mobile antennas. The 300-Watt power rating makes it just right for most transceivers. The PT-407 is an efficient tuner with a large airwound coil, a large balun for open-wire feed, and ceramic insulation throughout. It is housed in an 8" × 4" × 7" aluminum cabinet. All controls are on the front panel, coaxial connectors are S0-239, and porcelain insulators are used for balanced lines and single-wire inputs. The PT-407 antenna tuner sells for $149.95. For more information, write to *Palomar Engineers, 1924-F W. Mission Road, Escondido CA 92025.*

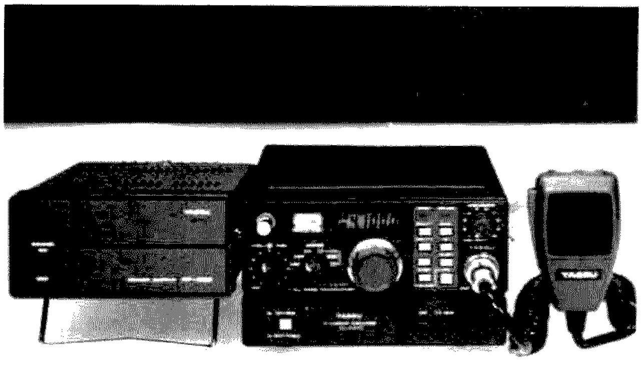
SATELLITE STATION

The Ten-Tec Model 2510 contains a 435-MHz USB/CW transmitter and a high dynamic range 2-meter-to-10-meter receive converter. The Model 2510 and a 10-meter SSB/CW receiver provide full duplex, transmit, and receive functions for operating on the upcoming OSCAR Phase 3 satellite in Mode B.

The transmitter operates from 435 to 435.5 MHz (coverage can be extended to 437 MHz with an optional oscillator). Ten Watts out is available in USB and CW. The receive portion converts 144-146 MHz to 28-30 MHz. A 12-volt power supply is required. Amateur net price for



AEA's MBA-RC reader/converter.



Yaesu's FT-290R transceiver.

the Model 2510 is $489. For more information, contact *Ten-Tec, Sevierville TN 37862.*

READER/CONVERTER

The Advanced Electronics Applications MBA-RC (Morse, Baudot, ASCII Reader/Code Converter) is actually several sophisticated devices all wrapped up in one package. The unit performs as a full-function decoder and display unit for Morse-, Baudot-, and ASCII-coded signals, operating directly from the audio output of any stable communications receiver. The MBA-RC also encompasses a Morse, Baudot, and ASCII encoder and code converter. The unit will perform serial-to-parallel and parallel-to-serial code conversions as well as cross-mode conversions. All the necessary analog processing and tone generation for two-way contacts in any MBA codes is included.

Other features include a built-in sidetone monitor, an FSK tone generator, and an automatic station ID message. The MBA-RC has a list price of $469.95. For more information, contact *Advanced Electronic Applications, PO Box 2160, Lynwood WA 98036.* Reader Service number 477.

PORTABLE TRANSCEIVERS

The FT-290R and FT-690R are multi-mode battery portable transceivers for 2 meters and 6 meters, respectively. Designed for 2.5 Watts output on SSB, CW, and FM (the FT-690R also has AM), these transceivers use liquid crystal displays and include scanning in variable steps. The FT-290R and FT-690R are powered by alkaline or nicad C-cells (not supplied). The FT-290R is priced at $399 and the FT-690R is offered for $379. For more information, contact *Yaesu Electronics Corp., PO Box 49, Paramount CA 90723.* Reader Service number 481.

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P/N	DESCRIPTION	P/N	DESCRIPTION
191-200	2 M 5/16-32 stud	191-800	1¼ M 5/16-32 stud
191-214	2 M BNC connector	191-814	1¼ M BNC connector
191-219	2 M PL-259 connector	191-819	1¼ M PL-259 connector

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Bandwidth(1¼M) 1.5:1 VSWR	5MHz min	Length collasped(2M)	8 15/16 (228MM)
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See List of Advertisers on page 114

HAM HELP

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Dick Levy WB3EVY
1331 Hale St.
Philadelphia PA 19111

I am looking for a copy of the tube chart and updating information for the B & K Precision Model 650 tube tester. I will pay postage both ways so that I can photocopy it.

Larry Schuldt
545 Willow Rd.
Marengo IL 60152

I need instructions for rewiring a standard 6-button telephone keyset so that it can be used with a Western Electric (Ma Bell) 212A modem. I will pay reasonable copying costs and postage.

Doug Ranz N8CDX
PO Box 1425
Warren MI 48090

I have a Jackson Electrical oscilloscope. If I can borrow either the complete manual (instruction) or schematic for Xeroxing, I will return and pay all postage.

Peter Dal Corobbo
18650 Marshall Ave.
Homewood IL 60430

I am looking for manuals/schematics for the following:

- Midland 13-505 2-meter transceiver
- Cleaver Company Model 33A electronic keyer
- Boehme 5C frequency shift converter
- Acton Labs, Inc., Model #810 VTVM

I am also looking for any modifications to improve the Ten-Tec Argonaut 505 transceiver, especially for vfo stability and receiver sensitivity. I will gladly reimburse copying/mailing costs.

Gary Kohtala WA7NTF
S & F Co., USAISD, Box 918
Ft. Devens MA 01433

I would like to buy a National NCX-A ac power supply.

Gary Jones
PO Box 26313
Houston TX 77207

I need help in obtaining a replacement nicad pack for a Wilson Mark IV 4-Watt, 2-meter hand-held transceiver.

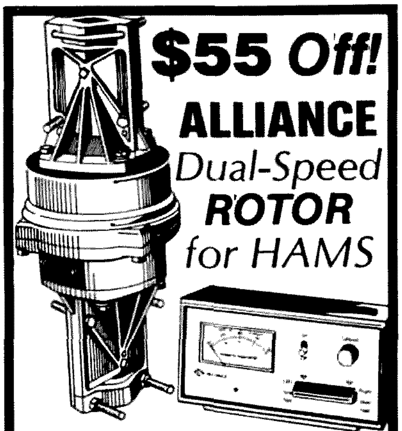
W.A. Lieseke WB7PUP
426 Bremerton Blvd.
Bremerton WA 98312

I need an operating manual/schematic for a Dumont Labs cathode-ray oscillograph, type #208. Costs paid.

Glenn Churchill KA2IOI
21 Bay St.
Glens Falls NY 12801

I would like to modify my Sony ICF-6800W to contain a noise blanker and to receive on longwave. I would like to locate some hardware or technical information concerning these modifications.

Mark Hunt
2135 South Union Ave.
Bakersfield CA 93307



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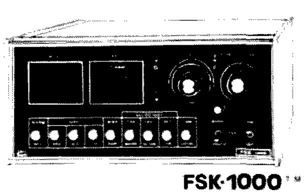

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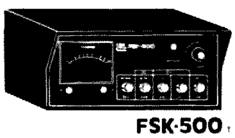

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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

found Haiti. The Bahamas are treacherous, so we were very lucky not to run onto any of the thousands of shoals and reefs.

Exhausted by the storm, we found a protected bay and anchored to rest. A couple of hours later, we awoke to find ourselves at gunpoint—faced by a bunch of excited Haitians who had sneaked aboard our ship. They spoke no English and no one in our group spoke any French... except me. I quickly started trying to remember what I could of my high school French, twenty years unused and mostly forgotten. The menacing guns prompted my memory.

It turned out that these were police from nearby Mole St. Nicholas. They were convinced that they had captured a bunch of invaders bent on taking over Haiti and were looking forward to a good deal of publicity and perhaps *rewards* from the government. The idea died hard, but I finally convinced them that we were a scientific team. How could I ever explain to these simple people that we were hams bent on visiting a deserted island to set up a radio station for *fun*?

We visited the town. Have you ever visited a place where the average income is about $50 per year? Some of our welfare customers should have a chance to see what real poverty can be!

From there we sailed across to Navassa and looked it over. Hmmm. Formidable. Just one place to get up the cliffs which completely surround the island ...and that via a wire rope ladder, with the waves shoving your boat into the undercut cliffs where it would be instantly shredded. We went back to Haiti to rent some Haitians and a small boat so we could get the ham gear onto the island.

At Cape Dame Marie, I once again managed to remember enough French to get the help we needed...and make the bargain. The head of the village made the bargain and gave us two Haitians and a boat. We found out later that he had no intention of giving the two chaps one cent of the pay. We towed the boat with the Haitians behind our ship back to Navassa. On the way one of them managed to fall overboard. Luck was with us and one of our group was looking that way when it happened so we were able to stop and circle around to pick him up. Damned fool couldn't swim and he was thrashing around, which attracts sharks. He wouldn't have lasted ten minutes.

With the help of the Haitians we got all of our ham gear from the boat to the top of the cliff. I'm afraid that *we* had to do most of the work. It was hot and dry. The damned island is covered with cactus and a wide variety of bushes with burrs. They seem to jump out at you if you even get close to them.

We set up two stations, one right at the top of the cliff and the other a couple hundred feet away. We had an enormous gas-driven power generator, two complete towers with beams, and rotors. We spared no expense to be well equipped. Our main receiver was a Drake 1A, a sideband (and CW) only receiver. That was a new way to go back in the early days of sideband.

The ship headed back to Haiti after leaving us off, scheduled to return for us in a few days... we hoped. Soon after the ship left, we found that we had a little problem. Oh, the rigs worked fine, but the heat was merciless and we found that our water supply was zilch. It turned out that the 50 gallons of water we'd brought had been in a rusty drum and had all leaked out on the trip down. Chet had noticed this and solved the problem by not bothering to bring the drum with us to the island. So we were faced with several days without water on this tropical desert island.

A couple of us explored the island, hoping to find some water. At the very top of the island was a tower with a beacon light. It was powered by acetylene which was piped up from bottles kept in a small shed near the tiny bay where we had our ham rigs. We found the remains of a house where, in earlier days, a lighthouse keeper had lived. Digging down through the remains of the house we found a cistern under the rubble. It had quite a bit of slimy water still left in it ...but water it was!

We brought the water down in cans and bottles and boiled it. After a day we got tired of the boiling procedure and decided to see if this was really necessary. Chet, who in many ways had managed to isolate himself from the rest of us, was chosen (without his knowledge) to be the guinea pig. We gave him the untreated water and waited to see if he would survive. He didn't seem to notice anything so we all switched to untreated water.

Navassa had not been active in many years so we had a ball on the air, knocking 'em off by the thousands. Talk about pileups!

When we were getting the equipment from the ship to the small boat and then from there up onto the island, some of the key beam antenna elements managed to slip out of the sling and fall into the water at the base of the cliff. I had my scuba tanks with me just in case of something like this, so I was elected to go after the lost aluminum.

It turned out that the water was only about 60 feet deep right there so I was able to surface dive and bring it all up. I can hold my breath for a minute or so and do pretty well in anything less than 75 feet without the scuba equipment...as long as it is just going down and then back up again. The many sharks and barracuda put the others off from much swimming. I tried to assure them that the fish were just curious and to ignore them, but I wasn't very convincing apparently.

Once the pileups ran down, we packed up and sailed back to Haiti where a couple of us left to fly home and back to business. Four of the group came back with the ham gear to Nassau. I eventually got back most of my ham gear, but never saw my two scuba tanks again.

I ran an article in *CQ* on the DXpedition, doctoring up the photo of the loading area and the cliff with a big "W2NSD" sign. This seemed better than the Coast Guard graffiti which was actually there. Later DXpeditions to Navassa brought paint planning to cover up my W2NSD with their calls. Not finding it, they painted their calls everywhere and made an awful mess.

I have a great 16mm color movie of the expedition which might be of interest some day. My slides were, unfortunately, out on loan to a ham club at the time I was fired from *CQ*, and I was *never able to get them* back.

In 1972, a group of hams from Atlanta decided to do a Navassa DXpedition trip and I got invited. The leader was Chaz Cone W4GKF, who also runs the yearly Atlanta Ham Festival and was recently involved with the new IBM microcomputer system.

This time we flew to Jamaica, where it was only an overnight boat trip to the island. Piece of cake.

The *Time* article was in error on a couple of minor points. The description of amateur radio as a burgeoning (to grow or develop rapidly) hobby is nice to read, but a bit optimistic. And I don't know how one makes mutton stew out of a goat. Goat stew, sure...and it can be delicious if you don't know the name of the goat involved.

They are right about one thing: DXpeditioning is exciting and fun. It *is* adventure and I guarantee that if you break loose and go on one, that you will never forget one single minute of the trip, no matter how long you live. There are not many adventures left like that in our protective (perhaps overprotective) world. Giving a few thousand hams a new country merely supports a branch of the hobby which is of questionable value—country chasing. Few hams in rare countries enjoy the pressures this forces on them, which leads to rare countries being even rarer...thwarting one of the basic values of amateur radio: international friendships.

Maybe we could set up a new rule which would *only* give country credit if you work a DXpedition.

CHINA!

Speaking of adventure...and keeping in mind the recent acti-

vation of China...perhaps you can take the time to break loose this fall and join me for a short trip to China. Ten of us went to Canton a little over a year ago and had an experience that none of us will ever forget.

This fall, starting in late October, there will be a tour of the electronics shows in Tokyo, Seoul, Taipei, and Hong Kong. From there we will go to Bejing for a couple of days and then on around to other electronics shows in Munich and London. Yep, this trip not only will get you into the most interesting places in Asia, including Peking, but is an around-the-world tour.

In general, the tour allows a couple of days for each electronics show and then one for travel, which means that the seven-city tour takes about three weeks. The cost is around $4,000 and that includes first-class hotels, all transportation, and perhaps more meals than you may be able to handle. Some of the meals on these tours are spectacular.

At the shows you get to see the latest in consumer electronic equipment, small computers, and so on. We'll be meeting hams, of course. If you are in electronics you may find some products to import, some firms which want your products, or firms to make things for you. These shows are about the only practical way to reach the smaller businessmen in Asia.

If you're interested in racking up some memories for a lifetime, drop me a note and I'll see that you get the dope on the tour. I've been on it twice now and find it first rate.

AN ARRL RESPONSIBILITY

Many years ago, an amateur organization was formed for the main purpose of providing lobbying for the hobby and for funding legal fights against laws which would be seriously harmful to the hobby. The League spent a fortune to put that new organization out of business, fearing any rivals...even for purposes for which they were not responsible.

Okay...this, to my mind, puts some responsibility on their shoulders to stand up and fight when restrictive laws are passed which are harmful to amateur radio. A case in point is a recent ordinance passed by the city of Burbank, Illinois...and this one is hard to believe.

Firstly, they just recently passed a one-year moratorium on issuing any permits for amateur antennas. Secondly, there is an $11 yearly fee for the inspection of each antenna, with a $10 follow-up fee if the antenna does not pass inspection and has to be reinspected.

Even antennas already in place must be registered, with a lot of legal details plus a proof of bond, proof of insurance on the antenna, proof of inspections, and so on. The bond, by the way, requires those responsible for the installation to put up $5,000 which is kept by the city. The wording of the ordinance could be construed to force any amateur putting up his own antenna to put up this $5,000 bond.

The real capper is the last part of the law which makes it illegal to cause any interference to radios, televisions, musical instruments, hi-fis, and so on. The fine set for this is a minimum of $25 and a maximum of $1,000 for each offense.

This sort of mischief *must* be fought. If it is permitted to stand in one city we can only expect it to proliferate, with each city pointing to the previous ones for legitimacy of the law. Yet fighting laws such as this, which seem silly, but which *are* laws, is an expensive undertaking. Who is going to pay to fight these laws?

I realize that there are a lot of amateurs who believe that *any* law must be obeyed and that it is un-American to even try to fight laws, good or bad. The fact is that there are a lot of really bad laws around and we either have to fight them or else give up more and more of our freedom.

You know, these same television viewers who gang up to force hams off the air will be the first ones to be screaming for ham communications when an emergency strikes. Speaking of emergency communications, the more we can organize this aspect of amateur radio, the stronger case we'll have when we have to deal with idiots such as the ones who put through the Burbank ordinance. Trying to reason with them as mere hobbyists trying to enjoy our hobby won't cut a lot of mustard.

It's funny about our laws. There has been a lot of fuss lately about driving and drinking, yet the courts seem to be fighting the laws and doing all they can to make sure that these drunken turkeys are back in cars again. We had one up here who had a record of drunk driving...and being let loose. He got soused one night, got behind the wheel ...turned his truck over... some people helped him turn it back again and he went on a few minutes later to wipe out three kids when he drove over the line into their lane. The police gave him a drunk meter test, but the court wouldn't allow the results to be mentioned in the trial. And so it goes with laws.

As far as crazy laws are con-

NEWSLETTER OF THE MONTH

This month marks the 12th part of *73*'s Newsletter of the Month series. It seems appropriate to close the first year of the contest by reviewing our eleven winners.—N8RK.

73's August, 1981, pick was the Richardson Wireless Klub's *Chawed Rag*. We appreciated their decision to cover upcoming club activities rather than the minute details of what went on at the last club meeting.

September's choice, *The Birmingham Amateur Radio Club Newsletter*, offered some good technical information. They included details about a simple RTTY station as well as featured a monthly "Technical Corner" in which real-life problems were discussed.

The October winner came from the San Diego Repeater Association. *Squelch Tales* boasts several pages of paid advertising each month. This defrays the publication costs, leaving the club's resources available for other projects.

The name *Squelch Tale* (this time with no "s") popped up again in November. We applauded the Chicago FM Club for their newsletter's eye-catching appearance: a consistent, clean-looking layout that ensures readers will spend some time with each issue.

Rounding out the 1981 winners was *The Scuttlebutt*, published by the Yankee Clipper Contest Club. The Clippers leave no stone unturned in a quest for club members who can provide connections to keep the cost of producing the *Scuttlebutt* to a minimum.

The Wheaton Community Radio Amateurs' *The Hamletter* caught our eye in January, 1982, with its two-color printing job and large number of black and white photos. *The Hamletter* masthead gives more than a list of officers; you'll also find details about when the club meets each month and where to look for the local repeaters and nets. These kinds of details make a newsletter friendly and helpful to new readers.

Humor was a key feature in the February winner, *The National Hampoon*. This publication of the Cleveland-based South East Amateur Radio Club relates a lot of information about the doings of individual members in a good-natured, fun way.

A statewide organization, the Wisconsin Association of Repeaters, was recognized for its newsletter in the March, 1982, issue of *73*. Our judges said, "A newsletter editor needs to keep in mind the audience he is trying to reach; if he gives his specialized audience the specialized information that they joined together to learn, they will be happy both with the newsletter and the club."

April's pick, the Metroplex Amateur Radio Communications Association newsletter, was recognized for its beautiful layout. This publication is another example of utilizing the talents of your club members—the editor is a commercial artist.

The May winner, *Kansas Amateur Radio*, is a good example of the fact that a publication doesn't always need the backing of a club. This statewide newsletter is a nonprofit venture that relies on readers for financial and editorial support. The result is very impressive.

Rounding out the first year of *73*'s Newsletter of the Month Contest was *The Log*, published by the Northern Ohio Amateur Radio Society. *The Log* includes something for everyone: reports for awards chasers, the contest crowd, DX hounds, traffic handlers and Novices.

cerned, we need to keep our eyes out for them and make sure that the ARRL, our *only* national club, is held responsible for our protection. Remember that they are our *only* club because they have spent the money it took to shoot down all the others. I'm not pot-shotting the League—only pointing out the facts and the responsibilities which we, as members, have to hold them to.

GENERAL NOTES

Every now and then a reader writes in with indignation that he (or she, rarely) has written me a letter and I have not personally answered. First, let me assure you that I do, indeed, read my mail. If you write to me, I will get the letter. The odds are not so good that you will get an answer, for the simple reason that I am but one person and you, the reader, are one of about 750,000 who read my magazines each month. You get the picture?

The average magazine editor writes a paragraph or two a month, an exercise not likely to get many readers fired up into a letter-writing frenzy. My extended editorials in five monthly magazines seem to flip the more delicately balanced (unbalanced?) readers into an ennui which is only surmounted by a long letter to Wayne...some enthusiastic and others vituperative. I seem to have a halo when viewed from some angles and distinct horns from others.

The fact is that I am someone who is trying mightily to make up for a deprived childhood. I really wanted to get a small printing press when I was a kid and have been taking out the resulting frustration on a growing number of not very innocent bystanders. I've got one now and I am having a ball.

Mind you, whether I can answer or not, I *do* want to hear from you. If you have anything to tell me about some of my editorials, I am always open to more data. Emotional reactions? No. Reasoned arguments? Sure. And if you run into newspaper or magazine clippings I might have missed, I would really appreciate getting them. You probably already know about my interests, such as anything to do with amateur radio, microcomputers, education, UFOs, radar, TVRO... things like that.

If you have a subscription problem, I'm sympathetic but almost as helpless as you are. Send word of your problem to *73* Subscription Dept., Box 931, Farmingdale NY 11737, and give *all* of the details. If this manages to fail to help after about six weeks, the next step is to write to the Circulation Manager, *73 Magazine*, Peterborough NH 03458. If that doesn't get action, try General Manager Debra Boudrieau, Wayne Green, Inc., 80 Pine Street, Peterborough NH 03458. If that, too, fails, let me know and I will rattle the chains.

If you need a back issue, try your best to identify it. We don't have a staff sitting around ready to try to find articles via a clue or two. Check our yearly index for hints. Check our Radio Bookshop for back issue prices... if we have the issues.

We have just enough people here to barely get the magazine out each month, so there is no one sitting around to give technical help or to design circuits for you. If you do have a question, please send it to the Technical Editor, *73 Magazine*, Peterborough NH 03458, complete with an SASE...and then hope that he gets some time. For the most part, you want to try to deal with the author of an article, remembering that he, too, may be up to here in trying to keep up with correspondence. It is not unusual for an author to get a thousand letters after a particularly interesting article. Now, how is he going to handle all of that?

ARTICLES

In the main, we are looking for construction projects. I have this bee in my bonnet about getting hams into building again, even if I have to drag them kicking and screaming into it...as I did with FM and repeaters. Boy! Did the readers hate FM when I started with *that*!

Articles are simple to write. You must type them in upper- and lowercase characters. You must double-space and leave generous margins on the pages for editing. We are now able to accept articles written on your TRS-80 I and III. Send in both the disk and a double-spaced printout. Then we will be able to do the editing on the printout and update the disk, finally dumping the edited article from the disk directly into our typesetting system. That will speed things up for us substantially.

We're also looking for articles which may help encourage schools to set up ham clubs. I feel that the future of both amateur radio and the technology of our country depends on this development.

Photos are most helpful in making the article interesting for the readers. If you have built a gadget and are not equipped with a first-rate camera, please send in the unit so that we can shoot it. We have a Mamiya RB-67 and can do a professional job. No more fuzzy Polaroids, okay? It takes a large-format camera and good lighting to turn out a good photo.

One more thing: Don't ever, ever send your article to two magazines at the same time.

THE PHONE

My apologies to readers wanting to get through to me on the phone. What with trying to manage six monthly publications, nine separate divisions of the company, do consulting, get to shows, give talks, keep up with the literature in two fields, and even ham a bit, my time even for telephone calls is very limited. This means it is getting more and more difficult to break through to me. But if I don't do that, I won't keep all these things growing...or be able to write all these editorials (*no smart remarks*).

In general, if my calendar permits, I'm available for talks to groups at $1,000 plus expenses for Sherry and me. Consulting runs about $500 a day plus expenses for the two of us, whether it is worth it or not. The same goes for the talks. The steep prices make it so that I have more time to do my work ...though I've had no complaints as yet.

CORRECTIONS

In the review of the CES 635 Microdialer (May, 1982, p. 138), we stated an incorrect price. The correct price for this microphone is $99.95.

Jeff DeTray WB8BTH
***73 Magazine* Staff**

In the April issue, page 10, the article "Watching the Weather" will undoubtedly interest many hams having the old deskfax in their parts closet.

There is, however, one portion of the layout which in my opinion can be simplified and possibly be made less expensive. This involves the need to reduce the drum rpm from 180 to 120 which, in the article, requires a 40-Hz voltage amplifier. The same rpm requirement can be met by leaving the motor as a straight 120-volt, 60-cycle unit and changing the output gearing.

Standard gear catalog listings do not show a 1.0-inch-center distance with the required 30 to 1 ratio. I guess nothing in our hobby comes easy, and a little work is required. There is, however, a gear set which comes close to the 1.0-inch-center distance spacing and the exact ratio.

The data are as follows:

- Worm Gear—32 diametral pitch, face width 7/32, bore: .25 diameter, hub diameter 11/16, projection 5/16, 60 teeth, 1.875 PD; catalog #D-1132, item code 13514.
- Worm—32 diametral pitch (double thread), PD .438, bore 3/16; LTHB item code 12922.
- Source—local industrial distributor handling Boston Gears. The manufacturer is Boston Gear Division, 14 Hayward St., Quincy MA 02171, (617)-328-3300.

Since the center distance will now be 1.156 inches with the new gears instead of the original 1.0 inch, it becomes an easy job with the help of a drill motor and a half-round file to lower the motor 5/32 of an inch. The worm will fit as is, but a new pin hole may have to be drilled. The worm gear must be reworked from a .250-diameter center hole to a .500 diameter. Once installed, the standard input of 120 volts at 60 Hz will drive the drum at 120 rpm.

This will eliminate the 80-kHz oscillator, the divider chain, the 40-Watt amplifier, and, of course, the autotransformer.

John Watzke K8OXI
9910 Shore Drive
Pigeon MI 48755

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

THE POSTMAN RETURNS

From Guam to Austria, Alaska to Florida, hams from all over the globe responded to the 1982 edition of the annual Fun! poll. The results, as always, were fascinating, and I wish to thank everyone who participated. I also want to thank my postman, who once again risked his back delivering all those envelopes.

Frankly, what always astounds me about this poll is not only the number of people who take the time to fill out a rather lengthy questionnaire, but also the number who write very long and generally thoughtful letters. Amateur radio will always be a vital hobby as long as there are people around who care about its future.

So thanks once again to the 1,016 of you who wrote in. Here's what you had to say.

ELEMENT 1—BACKGROUND

1) Sex:
A) Male—91% B) Female—9%
A three percent increase in the number of female amateurs over last year. An encouraging trend, but not conclusive enough to indicate a real trend.

2) Age:
A) 15 or below—5% B) 16-21—6% C) 22-39—49% D) 40-59—27% E) 60 and above—13%
Not very encouraging for our hobby's future.

3) License class:
A) Novice—6% B) Technician—10% C) General—30% D) Advanced—40% E) Extra—14%
Compared to last year, seems like there's been an upswing in upgrading.

4) Number of years licensed:
A) 1 year or less—4% B) 1-5 years—33% C) 6-10 years—8% D) 11-20 years—29% E) 21 years and up—26%
The old-timers reign.

5) Do you have a new (post-March '78) call?
A) Yes—45% B) No—55%
The new calls have an 8% increase over last year.

6) How many hours a week do you devote to amateur radio?
A) 0-1 hour—5% B) 2-5 hours—29% C) 6-10 hours—44% D) 11-20 hours—16% E) 21 or more hours—6%
About the same statistics as last year.

7) Which HF band do you most use?
A) 80-75 meters—15% B) 40 meters—20% C) 20 meters—21% D) 15 and/or 10 meters—35% E) Don't operate HF—9%
As the sunspots diminish, so does 15- and 10-meter operation—down from 43% last year.

8) Which VHF-UHF band do you most use?
A) 6 meters—3% B) 2 meters—71% C) 220 MHz—6% D) 420 MHz and/or up—1% E) Don't operate VHF-UHF—19%
Spread out, guys!

9) Which mode do you most use?
A) SSB—41% B) CW—20% C) FM—30% D) RTTY—5% E) Other—4%
If CW is so great, why does its popularity keep dropping?

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues, and other incidental expenditures.)
A) \$0-\$250—39% B) \$251-\$500—30% C) \$501-\$1,000—24% D) \$1,001-\$2,500—4% E) \$2,501 and up—3%
A continued downward trend.

ELEMENT 2—SOCIAL CHARACTERISTICS

11) Has amateur radio influenced your career choice?
A) Greatly—25% B) Somewhat—26% C) Not at all—49%
Quite an impressive statistic, really.

12) Do you answer QSLs with no return postage?
A) Yes—76% B) No—24%
The fact that the word "Novice" was eliminated from this question, plus two postage increases, might account for the 20% positive response drop.

13) Politically, how would you define yourself?
A) Conservative—40% B) Middle-of-the-road—51% C) Liberal—9%
I've always felt hams were a pretty conservative lot, and it looks like my suspicions were correct. Being a C person, I feel pretty lonely.

14) Do you think amateur radio will exist 20 years from now?
A) Yes—87% B) No—13%
Hams are a pretty optimistic lot.

15) Have you ever had a fight with a family member over amateur radio?
A) Yes—71% B) No—29%
Wow! I want the first aid concession at the next hamfest.

16) Do you have any relatives who are hams?
A) Yes—49% B) No—51%

17) Are most of your friends (more than half) hams?
A) Yes—40% B) No—60%
Takes one to know one—almost.

18) Did you ever use a "cheat book" (not counting the ARRL *License Manual*) to upgrade your license?
A) Yes—16% B) No—84%
No comment.

19) If someone offered you five million dollars, tax-free, on the condition that you give up amateur radio forever, would you?
A) Yes—81% B) No—19%
We raised the ante by four million over last year and got 20% more takers. As for the other 19%, I still say every man has his price. How about 10 million?

20) Do you belong to a local ham radio club?
A) Yes—45% B) No—55%
Not good enough.

21) Have you ever attended a ham flea market?
A) Yes—79% B) No—21%
If you haven't, you don't know what you're missing.

22) Have you ever attended the Dayton Hamvention?
A) Yes—24% B) No—76%
I haven't made it since 1978, but it was a gas!

23) Would you pay five dollars to join the ARRL if they offered no magazine, QSL services, awards, or technical and instructional help?
A) Yes—22% B) No—78%
Guess it must be that great magazine that makes the League. I, for one, love to regale my friends on 15 with the latest activity reports.

24) Would you like to see another national organization compete with the ARRL?
A) Yes—22% B) No—78%
Hoo boy! Did I raise a hornet's nest with this one. One respondent even went so far as to call me a rabble-rouser. I take no stand on this question, but judging from the results, I certainly wouldn't invest my money in the stock of a competitor.

ELEMENT 3—OPERATING HABITS

25) Would you favor a licensing system that had only two classes: Novice and General or Communicator and General?
A) Yes—58% B) No—42%
So much for incentive licensing.

26) Would you like to see the FCC turn over amateur testing responsibility to clubs?
A) Yes—61% B) No—39%
Many of those who were against were afraid of abuses.

27) Do you think religious and politically-oriented nets have a place in ham radio?
A) Yes—79% B) No—21%
Hey, you guys who picked B. Haven't you ever heard of free speech?

28) Should contests be outlawed?
A) Yes—31% B) No—69%
Emotions ran hot and heavy on this one.

29) Do you think the FCC should assign exclusive frequencies and times to nets?
A) Yes—7% B) No—93%
Not a very attractive proposition.

30) Do you think the FCC should assign exclusive frequencies to repeaters?
A) Yes—20% B) No—80%
I don't like the idea, either.

31) Should there be a no-code, VHF and above, "Digital class" license? This license would require a heavy theory test and carry no phone or CW privileges (except perhaps for ID purposes).
A) Yes—34% B) No—66%
I can't figure it: Some letters were downright hostile to the influx of computer users on the bands, as if they were taking over the hobby. Many respondents seemed to welcome the digital ticket idea, but not enough to make a majority.

32) Should there be a no-code 220-MHz, "Communicator class" license? This license would require a moderately difficult theory test and carry only F3 privileges at a maximum of 50 Watts.
A) Yes—41% B) No—59%
A hard core of respondents seemed to be against dropping the code test for any type of license.

33) Do you own a microcomputer?
A) Yes—39% B) No—61%
I can't see how a technically-inclined person can be without one.

34) What sort of CW sending device do you most often use?
A) Straight key—56% B) Keyer—25% C) Bug—4% D) Keyboard—6% E) Never operate CW—9%
Last year, I accidentally left out bugs and received scores of letters asking why. This year, I insert the classification and find out only 4% use them. Can't win.

35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes—75% B) No—25%
Compared with last year, our skills are diminishing.

36) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes—11% B) No—89%
About the same as last year.

37) Do you think the FCC affects amateur radio in a positive manner?
A) Yes—48% B) No—52%
A little more positive than last year.

38) Do you ever speak to foreign, non-English-speaking hams in their own language?
A) Always—3% B) Sometimes—15% C) I attempt it—25% D) Rarely—6% E) Never—51%
No substantial change over last year.

39) Do you feel yourself competent to replace the finals in a tube-type rig?
A) Yes—91% B) No—9%
Does anyone still own a tube rig? Only kidding!

40) Do you feel yourself competent to replace the finals in a transistor-type rig?
A) Yes—80% B) No—20%
A soldering iron? I thought it was an electric cigar!

41) Have you ever built an electronic project from a kit?
A) Yes—98% B) No—2%
A ham isn't a ham unless he's unpacked all of those little brown bags before opening the instruction booklet

42) Have you ever "home-brewed" an electronic project from a book or magazine?
A) Yes—75% B) No—25%
A bit down from last year. For shame on those who haven't.

43) Have you ever designed your own electronic project?
A) Yes—61% B) No—39%
Hasn't everyone?

44) What do you think of contesting?
A) Great—15% B) Good—20% C) Okay—17% D) Don't like it—29% E) Despise it—19%
You're 59 New York.

45) What do you think of DXing?
A) Great—40% B) Good—31% C) Okay—19% D) Don't like it—5% E) Despise it—5%
QSL via the bureau.

46) What do you think of repeaters?
A) Great—35% B) Good—30% C) Okay—22% D) Don't like them—8% E) Despise them—5%
Wait for the beep.

47) What do you think of traffic handling?
A) Great—10% B) Good—35% C) Okay—40% D) Don't like it—14% E) Despise it—1%

48) Do you plan to use Phase III OSCAR within a year of its launch?
A) Yes—28% B) No—72%
Looks like that passband is going to get pretty crowded.

49) Do you plan to use the new 10.1-MHz band within one year of its opening?
A) Yes—40% B) No—60%
That should be around Jan. 1, 2065, at the rate the U.S. Senate is moving.

50) Do you believe amateurs should have the right to build, use, and sell equipment for the reception of subscription television?
A) Yes—24% B) No—76%
I should have left "sell" out of the question. Seems many amateurs think they should be able to pirate signals for their own use, but not for others.

SELECTED COMMENTS

Too many private repeaters tying up amateur frequencies. Some systems have only three people on them.—KB6BO.

Morse code should be outlawed as a requirement, although I love it.—K6XR.

Amateur radio needs quality, not quantity. We should strive to keep the standards high.—WB5ZDP.

We will keyboard and computerize ourselves away from the human fashion of hamming.—W4YDL

Let's have more polls—these are FUN!!—KF4W.

I think the Communicator class is a very good idea. I am partially deaf. Code is very hard for me. This may give deaf people a chance to communicate by RTTY.—KA7CYE.

After 21 years of hamming, I earned my Extra class license and not a word of congratulations from the ARRL or any manufacturer of ham gear.—KD1J.

This has been the only column you've put in print that I knew all the answers to.—N7AVM.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CANADA CONTEST

Starts: 0000 GMT July 1
Ends: 2400 GMT July 1

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs, and everybody works everybody. Entry classes include single operator/all bands, single operator/single band, and multi-operator/single transmitter/all bands. There are separate single-operator QRP (5 W dc, 10 W PEP out) and single-operator non-Advanced amateur classes.

Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band, once on CW and once on phone. No crossmode contacts, and no CW contacts in the phone bands are allowed.

EXCHANGE:

Signal report and consecutive serial number starting with 001; VE1 stations should also send their province (NS, NB, PEI).

SCORING:

Score 10 points for each contact with Canada, 1 point for contacts with others. VEØ counts as Canada. Score 10 points for each contact with any CARF official news station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band, on each mode (12 provinces/territories × 8 bands × 2 modes for a maximum of 192 possible multipliers). Contacts with stations outside Canada count for points but not multipliers.

FREQUENCIES:

Phone—1810, 3770, 3900, 7070, 7230, 14150, 14300, 21200, 21400, 28500, 50.1, 146.52.

CW—1810, 3525, 7025, 14025, 21025, 28025, 50.1, 144.1.

Suggest phone on the even hours (GMT), CW on the odd hours (GMT). Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

A plaque will be awarded to the highest score single operator/all bands entry. Certificates will be awarded to the highest score in each category in each province/territory, US call area, and DX country.

ENTRIES:

A valid entry must contain log sheets, dupe sheets, a cover sheet showing claimed QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier check lists are available. Entries should be mailed within one month of the contest, with your comments, to: CARF, PO Box 2172, Stn. D, Ottawa, Ontario K1P 5W4, Canada.

Results will be published in *TCA*, the Canadian amateur magazine. Non-subscribers may include an SASE for a copy of the results.

CALENDAR

Jul 1	**CARF Canada Day Contest**
Jul 10-11	**IARU Radiosport**
Jul 17-18	**International QRP Contest**
Jul 17-18	***A5 Magazine* Worldwide SSTV DX Contest**
Jul 24-26	**CW County Hunters Contest**
Aug 7-8	**ARRL UHF Contest**
Aug 14-15	**European DX Contest—CW**
Aug 14-16	**New Jersey QSO Party**
Aug 21-22	**SARTG Worldwide RTTY Contest**
Aug 21-22	***A5 Magazine* F5TV UHF Contest**
Aug 28-29	**Occupation Contest**
Sep 11-12	**ARRL VHF QSO Party**
Sep 11-12	**European DX Contest—Phone**
Sep 11-12	**Cray Valley RS SWL Contest**
Sep 18-20	**Washington State QSO Party**
Oct 2-3	**California QSO Party**
Oct 16-17	**ARCI QRP CW QSO Party**
Oct 16-17	**Pennsylvania QSO Party**
Nov 6-7	**ARRL Sweepstakes—CW**
Nov 13-14	**European DX Contest—RTTY**
Nov 20-21	**ARRL Sweepstakes—Phone**
Dec 4-5	**ARRL 160-Meter Contest**
Dec 11-12	**ARRL 10-Meter Contest**
Dec 19	**CARF Canada Contest**

INTERNATIONAL QRP CONTEST

Starts: 1500 GMT July 17
Ends: 1500 GMT July 18

The first International QRP Contest is being sponsored by the World QRP Federation (WQF) and offers a variety of awards for leading stations. This is a CW-only event with separate categories for single- or multi-operator stations, and for those operating fixed or portable. Multi-operator stations may be on the air for the entire 24-hour contest period, while single-operator entries must be off the air for at least an eight-hour period. All stations may be worked once per band for QSO and multiplier credits.

EXCHANGES:

RST, QSO serial number, and class (599 001/2D). Add X after RST if crystal-controlled (559X 001/2D).

FREQUENCIES:

The traditional QRP frequencies will be utilized: 1810, 3560, 14060, 21060, and 28060, all plus or minus QRM.

OPERATING CLASSES:

1 = single operator, 2 = multi-operator, A = fixed station up to 2 Watts input or 1 Watt output, B = fixed station up to 10 Watts input or 5 Watts output, C = portable station up to 2 Watts input or 1 Watt output, D = portable station up to 10 Watts input or 5 Watts output, and E = QRO stations of more than 10 Watts input or 5 Watts output.

SCORING:

Count 1 point for QRP to QRO contacts, 2 points for QRP to QRP. For multipliers, count 1 if both stations are in the same country, 2 if the other station is in another country on the same continent, 3 if the other station is in another country and on another continent. For scoring purposes, all call areas within a country are counted as multipliers (e.g., 10 for W/K, 8 for VE, 10 for PY, etc.). For crystal stations with a maximum of three crystals per band, QSO and multiplier points are doubled. Contacts with crystal-controlled stations count double. Band points are the QSO points per band times the multiplier points per band. Final score is the sum of band points from each band.

AWARDS:

DL-AGCW will provide awards for fixed station leaders and band leaders. QRP ARCI will provide plaques to the first place single- and multi-operator portable stations worldwide plus certificates for the multiple- and single-operator portable station in each country with two or more entries.

ENTRIES:

Send logs within six weeks of conclusion of the contest as follows: fixed stations to Siegfried Hari DK9FN, Spessartstrasse 80, D-6453 Seligenstadt, West Germany; portable stations to William W. Dickerson WA2JOC, 352 Crampton Drive, Monroe MI 48161, USA.

INTERNATIONAL WORLDWIDE DX SSTV CONTEST

Starts: 0000 GMT July 17
Ends: 2400 GMT July 18

This is the second annual DX SSTV contest sponsored by *A5 ATV Magazine*. This is a 48-hour SSTV video contest using 80 through 10 meters within the recommended SSTV calling/operating frequencies listed below. To encourage use of all bands, extra bonus points are granted on the 10-, 15-, 40-, and 80-meter band segments. Single- and multi-operator stations are recognized with cross-band contacts not permitted. Individual contacts count only

once per band with repetitive multi-band contacts acceptable.

Callsigns and video reports must be in "video" form. Mugshots of the station operator, family, or friends can count only once. Slower clock-rate speeds are encouraged in either 128/16.5-second or 256/31-second timebases. Color work must contain a minimum of 2-color overlay to qualify with standard RGB frame transmissions. Motion SSTV must have a minimum of 2 frames sent with automatic-receive switching circuitry or manually operated switching by the receiving operator, and 64 × 64 "quadrant" storage of no less than 4 separate pictures with replays.

SCORING:

Each SSTV two-way contact is worth 5 points within the same country and 10 points for DX out-of-country. Contact bonus points are available as follows: mugshots—1 point, slow speed—2 points, quad frame—3 points, motion SSTV—4 points, high resolution—5 points, and *color* SSTV—10 points.

A band multiplier of 3 can be claimed for contacts on 40 and 30 meters, and 2 for contacts on 10 and 15 meters. Stations with over 25 DX countries worked—add 25 points, 50 DX countries—add 50 points, and over 100 DX countries—add 100 points!

FREQUENCIES:

Advanced/Extra—3845, 7220, 14230, 21340, 28680, 50.150.
General—3990, 7290, 14340, 21440, 28680, 50.150.

AWARDS:

First-place winner receives 3-year subscription (worth $60) to *A5 ATV Magazine* with front-cover picture plus a Gold Certificate. Second- and third-place winners receive one-year subscriptions and Gold Certificates. All entries regardless of score *receive* Gold Certificates suitable for framing. Results will be in the November issue of *A5 ATV Magazine*.

ENTRIES:

Submission of logs and totaled scores must be postmarked no later than August 1st and submitted to: Contest Manager, *A5 ATV Magazine*, PO Box H, Lowden IA 52255-0408. Logs will be returned as will any photos, etc. Some log sheets and DX country lists are available from WB0QCD.

RESULTS

1981 PENNSYLVANIA QSO PARTY
(QSOs and Score)

Top Seven—Eastern PA

WB3DJF	748	97,216
K3ONW	543	79,401
AA3B	570	77,166
KC3N	559	76,328
K3NB	539	72,200
N3AMK	568	70,437
AI3Q	491	57,684

Top Seven—Western PA

AD8J/3	502	62,628
N3BBH/3	580	51,216
KA3BFX	398	45,177
KA3FMH	382	42,864
WB3IET/3	396	40,788
AG3H	250	38,500
N3BMV	390	37,536

Out of State—Top Ten

AE3Y	311	23,072
VE3BR	234	18,467
K2POF	166	11,500
W2IMO	171	11,398
K9GDF	170	10,951
K1BV	156	8,677
W1DWA	128	7,943
W2EZ	110	7,755
N2CIW	142	7,384
N4FAI	110	6,750

Multi-Operator

K3ZUF	1384	194,207
KB3S	526	73,593
K3CR	583	70,750
AG3R	417	52,781
KB3NQ	369	35,424
KA3DXR	247	22,244
W3YA	102	6,075
Ctr.Co. EOC (WB3AEI,WB3DVH,WN3VAW)	31	819

Mobiles

WA3QNT/m	269	24,157
		(from 9 counties)
K3BS/m	327	19,293
		(from 18 counties)
N2BLT/m	104	4,368
		(from 6 counties)
Check log:		
W3HDH/m	433	39,849
		(from 15 counties)

Clubs

Clubs	Location	Score	Entries	Top Scorer
Penn Wireless Association	Bucks County	425,570	16	WB3DJF
Erie Amateur Radio Association:	Erie	296,651	22	KA3BFX
Nittany Amateur Radio Club	State College	264,723	13	N3BBH
Delaware-Lehigh Amateur Radio Club:	Northampton Co.	217,510	8	K3ZUF
Hazleton Amateur Radio Club	Hazelton	161,728	11	AI3Q
Penn State University Radio Club	University Park	95,509	3	K3CR
Frankford Radio Club	Philadelphia	74,181	2	—
Mon-Valley Amateur Radio Association	Washington Co.	73,593	2	—
Murgas Amateur Radio Club	Luzerne County	63,399	6	WB3FYT
Carbon ARCs	Carbon County	61,739	4	WB3JZE
Point Radio Operating Society (PROS)	Allegheny Co.	36,231	2	—
Harrisburg Amateur Radio Club	Harrisburg	35,226	4	W3ADE
Reading Amateur Radio Club	Berks County	33,198	3	WA3JXW
Tioga County Amateur Radio Club	Tioga County	26,929	2	—
Mobile Sixers	Chester County	9,505	2	—

CW COUNTY HUNTERS CONTEST

Starts: 0000 GMT July 24
Ends: 0200 GMT July 26

The CW County Hunters Net invites all amateurs to participate in this year's contest. All mobile and portable operation in less-active counties is welcomed and encouraged. Stations may be worked once on each band, and again if the station has changed counties. Portable or mobile stations changing counties during the contest may repeat contacts for QSO points.

EXCHANGE:

QSO number; category (P for portable, M for mobile); RST; state, province, or country; and US county. Stations on county lines give and receive only one QSO number, but each county is valid for a multiplier.

FREQUENCIES:

Frequencies are 3575, 7055, 14070, 21070, and 28070. It is strongly requested that only P or M category stations call CQ or QRZ on 40 meters below 7055 and on 20 meters below 14070, with all other stations spreading out above those frequencies.

SCORING:

QSOs with fixed stations are 1 point, QSOs with portable or mobile stations are 3 points. Multiply the number of QSO points times the number of US counties worked. Mobiles and portables calculate their score on the basis of total contacts within a state for the state certificate, and calculate their score on all operation if they operated from more than one state in competition for the High Portable or High Mobile Trophy.

AWARDS:

Certificates will be awarded in three categories:

1) Highest fixed or fixed-portable station in each state, province, and country with 1,000 or more points.

2) Highest station in each state operating portable from a county which is not his normal point of operation, with 1,000 or more points.

3) Highest station in each state operating mobile *from* 3 or more counties with a minimum

RESULTS

RESULTS OF *A5 ATV MAGAZINE* WORKED ALL STATES SSTV CONTEST

(Full results appeared in the June issue of *A5 ATV Magazine*, PO Box H, Lowden IA 52255-0408.)

The top 5 entries from 59 entries received:

1st—Luis Chartarifsky XE1LCH
2nd—Roland Soucie N6WQ
3rd—Larry Benson K9KQO
4th—John Hudak III KA3X
5th—Harry Harchan W2GND

of 10 QSOs in at least each of 3 counties.

Trophies will be awarded to the highest single-operator station in the US in categories P and M. The Awards Committee may issue additional awards.

ENTRIES:

Logs must show category, date/time in GMT, station worked, band, exchanges, QSO points, location, and claimed score. All entries with 100 or more QSOs *must include a check sheet of counties worked or be disqualified from receiving awards*. Enclose a *large* SASE if results are desired. Logs must be postmarked by September 1st and sent to: CW County Hunters Net, c/o Jeffrey P. Bechner W9MSE, 673 Bruce Street, Fond du Lac WI 54935.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

CHINA

China. The very word conjures up visions of mystery and Marco Polo. And to DXers China means Number 1 on everyone's Most Wanted List. The *DX Bulletin* annual survey (the benchmark of the Most Wanted Lists) continues to show China in the top spot again this year.

Over the past few years, the China rumors have been flying thick and fast. "China will be opening soon." "Hundreds of China stations will start operating next week." And so on. One prominent New Zealand amateur came within inches of spurring China into the amateur radio arena, but his US citizenship sabotaged the effort.

The positive attitude of the China authorities encourages the rumors and rumor-followers. Unlike many countries where amateur radio is flatly prohibited, China has been enthusiastic about the future role of amateur radio. It is just a matter of time.

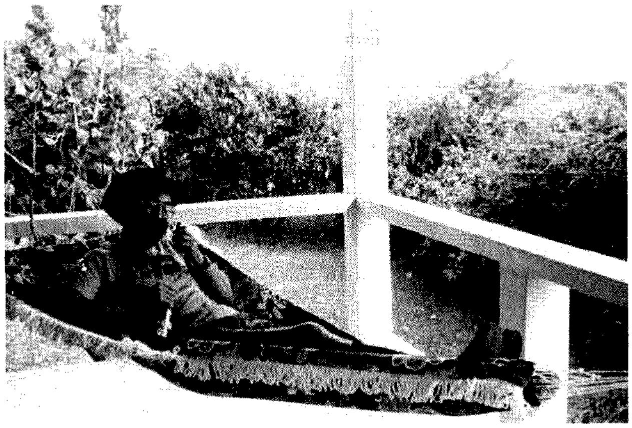
That time may have finally come. On March 29, BY1PK appeared on 15 meter CW, working (of course) JAs.

Tom Wong VE7BC clearly performs the role of hero in this operation. His tireless efforts over the past few years have just begun to provide fruit. Tom has been instrumental in funneling equipment, training materials, books, and expertise from the ARRL and other stateside organizations to the appropriate authorities in China.

The BY1PK operation represents not a one-shot, contest-style operation, but the reawakening of amateur radio in the most populated country in the world. Although China will move slowly in the amateur radio field, it is moving in the right direction, and the next few years should see that Number 1 ranking slip further and further down the Most Wanted survey.

The "Other" China

The neophyte DXer, unfamiliar with the prefix BY, might turn to the International Prefix Allocation List to locate the source of the signals. The list shows all the B callsigns as belonging to China. The *Callbook* shows no China amateurs. Or does it?



In addition to working on his monthly DX column for 73 Magazine, *Chod Harris VP2ML leads a very demanding life. Here he's shown slaving away at his VP2 QTH.*

Just before the BY listing in the *Callbook* is the BV listing: two amateurs. If the BY call signifies China, what does the BV signify? Answer: The "other" China—our former ally, Taiwan, the Republic of China.

Not to be confused with the People's Republic of China, Taiwan is the last refuge of the anti-Communist forces driven out of mainland China after World War II. The Nationalist government of Taiwan considers itself to be the legitimate authority over all of China, hence the BV callsign.

But only two amateurs in a country as rich and well populated as Taiwan? A small amateur population is more typical of a smaller, undeveloped country, a distinction hardly appropriate for industrial Taiwan. So why only two hams?

The question is not why there are only two amateurs in Taiwan, but rather why there are any amateurs at all. Taiwan considers itself still at war with the mainland government. Both sides would like the other to go away, to reunite the country (shades of Korea and Vietnam here). And military governments under states of war or emergency are notoriously reluctant to allow free use of the amateur bands.

One of the very first proclamations under the martial law in Poland was the crackdown on amateur radio activities. Even in the US, amateur radio activity ceases during wartime.

We can understand why a country at war would feel uncomfortable about permitting unrestricted use of the amateur bands. The independence of the amateurs and the tremendous flexibility of amateur equipment are powerful communications tools to those on the outs with the government.

The increasing use of amateur radio gear in illegal drug shipments demonstrates that ham radio equipment and expertise can be a disturbing factor in sensitive political differences. Hence many countries simply prohibit all amateur radio activities; witness Albania, for example.

So we return to our original question: Why is there any amateur radio activity at all from a divided country engaged in a "civil war"?

First, there is really only one amateur in Taiwan, with two callsigns: Tim Chen operates BV2A on CW and BV2B on SSB. Somehow a single individual has obtained permission to operate amateur radio in Taiwan. But that permission is probably the most restricted amateur radio authority short of a flat-out ban. Tim's operating authority restricts him to specified times and frequencies. Can you imagine your radio license specifying the exact frequency and time of operation? It would certainly put a crimp in your DXing.

Fortunately for DXers throughout the world, Tim maintains his activity, keeps to his schedules, and regularly provides QSLs from the "other" China.

Look for Tim Wednesdays between 1200 and 1600Z on one of the following frequencies: 14025, 14040, 14218, or 14250. Tim usually shows up on CW first and switches to SSB a little later. Tim also has operating permission Saturday from 2300 to 0200Z. When band conditions permit 15-meter operation, Tim operates on 21030, 21110, 21270, and 21350. And more recently Tim has added the 10-meter frequency of 28530 to the possibilities.

Tim QSLs consistently either direct to Box 101, Taipei, Taiwan, Republic of China, or via QSL manager K2CM at his *Callbook* address.

If you hear BV2B on 20 meters and have trouble breaking through the pileup, perhaps your choice of phonetics could use improvement. Let's continue our discussion from last month.

PHONETICS

Last month we discussed the different kinds of phonetic call-

signs: standard, place names, and "cute" phonetics. Now we look at how you evaluate your own choice of phonetics and how you can select alternate phonetics.

A phonetic call should have two characteristics: The call must be unambiguous, and it should punch through the pileup. Removing ambiguity from a potential phonetic callsign is easy: Pick easily recognized words which have no common homophones (a word that *sounds* similar, but is spelled differently).

A couple of examples of what *not* to do might illustrate this: A W5 called me using "Motel" as a phonetic. The confusion between this and "Hotel" is obvious. And one Field Day, an amateur called me with the phonetic suffix, "Fuzzy Wuzzy Wabbit!" I was forced to ask for clarification: "Is that R as in Rabbit or W as in Wabbit?" Back came the reply, "Wabbit! Wabbit, wabbit, wabbit!" Memorable, but not very effective in a DX pileup. Stick with less confusing phonetics.

Selecting a phonetic call with punch is more difficult. I suggest going to a station equipped with an oscilloscope monitor of the outgoing signal. Try different phonetics and combinations of phonetics while watching the scope. Look for those phonetics which give the greatest average output, or the "blockiest" output pattern. Lacking a scope, try watching the relative power output meter on your rig. Again, try to keep the average power as high as possible.

The two "cute" phonetics mentioned last month (W1NoGood and WA9BlackWhiteYellow) are very effective because they share the two most important characteristics of good phonetics: They are unambiguous and they really cut through the pileups. Watch your output meter while saying "No Good" or "Black White Yellow" to see what a good phonetic does for your average output.

Also, individual amateurs in foreign countries might have a particular difficulty with one of your choices. For one reason or another, an amateur might have a block against that particular phonetic and fail to understand even under good conditions. Be flexible, and don't be afraid to shift to a backup set of phonetics when the first fails after a couple of tries. On the other hand, wait until the DX station is obviously struggling with the call before you switch your phonetics. You use phonetics to *reduce* ambiguity, and throwing dozens of different phonetics at the DX station will more likely confuse the poor DXer and decrease the chances for a successful contact. Keep your different phonetics to a minimum and use an alternate set only when necessary.

I found that three sets of phonetics covered almost any situation. A short, punchy set worked for good conditions, where I knew my call would get through, or for tailending: "Sugar Queen Baker." I tried a slightly longer set when the first one failed: "Sierra Quebec Bravo." This set had the advantage of very high average output; I could really hang the relative power output meter up with Number 2. The final set was the lousy condition set: "Santiago Quebec Bolivia," to be used only under adverse circumstances, when repetition of the other two failed miserably. I used this phonetic *after* contact was established. If the DX station did not have my call correctly, or continued to struggle with the call, I would switch to the longer phonetic.

Many amateurs use phonetics for the *suffix* of their call but ignore the *prefix*. When the only stateside calls began with K, W, WA, and WB, the possibilities for error remained small. But even the advent of WD calls rapidly discredited this practice. The current proliferation of similar sounding prefixes (KB, KD, KE) makes the use of phonetics for both prefix and suffix mandatory.

Testing Your Choice

The ideal way to test your phonetics is to get on the air and start throwing your call into pileups. Does the call get through? Do the DX stations get your call correctly? The best test of a given set of phonetics is success. If it works, try it again. If it works again and again, use it a lot. If it does not cut the pileup, try another combination until you find the most effective.

One sure sign that a given phonetic doesn't work for your combination of voice and station is a pattern of consistent error when the DX station comes back to you. For example, I quickly found that "Whiskey Alpha One Sierra Queen Bravo" was often answered with WA1S something B." Watching the output scope showed me the problem: Output dropped to near zero on the "Queen." That letter wasn't getting through. A switch to "Quebec" (although opening the door for confusion with Canadian stations) eliminated the lost letter phenomenon.

More Than One?

After experimenting in front of the output monitor (into a dummy load or empty band, of course) and testing the DX waters in numerous pileups, you will find a phonetic call which meets the requirements of lack of ambiguity and good penetrating power. You will be tempted to use this phonetic call in every DX circumstance. Unfortunately, life, and especially DXing, is not that simple. The best set of phonetics for one band or band conditions might not be competitive at *another* time. A short, snappy phonetic call might be just the thing for 10 meters when it is wide open, but the same combination on 80 might be destroyed by a single static crash.

Finally, phonetics are very personal. What works for one voice, rig, and microphone might not work for another combination. Guest operators at the big contest multi-multis are familiar with this problem. Each operator has to experiment to find the phonetics which work best. Meanwhile, see you in the pileups! Next month we'll *have a* treat for the CW DXers, as we examine zero-beating.

NOTES FROM ALL OVER

JO1CRA gives the following address for WH0AAB: Hide-haru Aimono, 2644 Tsuruda, Utsunomiya-City, Tochigi, 320 Japan. N0BNY reports a July operation from VP2K (on his honeymoon!). Pat also QSLs the VP1MK operation at his home address: 2770 South 13th Street, Omaha NE 68108, with SASE. K9MK/5 handles his own QSLs for his /VP2A and /V2A operations at 6061 Dunson Court, Watauga TX 76148. V2AMK should be QSLed to N0DH/7 at 2031 East Gary, Mesa AZ 85203. And finally Nick Percival 9Y5NP of the Trinidad and Tobago Amateur Radio Society announced the 50 Years of Amateur Radio special prefix for his country: 9Y50. Look for Nick and other Trinidad amateurs using this prefix for the rest of 1982.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

WORKED ALL ZONES

The WAZ award will be issued to any licensed amateur station presenting proof of contact with the forty zones of the world. This proof shall consist of proper QSL cards which may be checked by any of the authorized *CQ* checkpoints or sent directly to the WAZ Award Manager, Mr. Leo Haijsman W4KA, 1044 Southeast 43rd St., Cape Coral FL 33904. Many of the major DX clubs in the US and Canada and most national amateur radio societies abroad are authorized *CQ* checkpoints. If in doubt, consult the WAZ Award Manager. Any legal type of emission may be used, providing communication was established after November 15, 1945.

The official *CQ* WAZ Zone Map, and the printed zone list which follows these rules, will be used in determining the zone in which a station is located.

Confirmation must be accompanied by a list of claimed zones, using *CQ* form 1479, showing the call letters of the station contacted within each zone. The list should also clearly show the applicant's name, call letters, and complete mailing address. The applicant should indicate the type of award for which he is applying, such as all-SSB, all-CW, or mixed. In re-

mote locations and in foreign countries, a handwritten list may be submitted and will be accepted for processing, provided the above information is shown.

All contacts must be made with licensed, land-based, amateur stations operating in authorized amateur bands.

All contacts submitted by the applicant must be made from within the same country. It is recommended that each QSL clearly show the station's zone number. When the applicant submits cards for multiple callsigns, evidence should be provided to show that he or she also held those call letters.

Any altered or forged confirmations will result in permanent disqualification of the applicant.

Include with the application the processing fee (subscribers, $4.00; non-subscribers, $10.00) and a self-addressed envelope with sufficient postage stamps or international reply coupons to return the QSL cards by the class of mail service desired and indicated. *CQ* subscribers should include a recent mailing label (or copy) with application. International reply coupons equal in redemption value to the processing fee are acceptable. Checks should be made out to Mr. Leo Haijsman, WAZ Award Manager.

In addition to the conventional certificate for which any and all bands and modes may be used, specially endorsed and numbered certificates are available for phone and single-sideband operation. The phone certificate requires that all contacts be two-way phone; the SSB certificate requies that all contacts be two-way SSB.

If, at the time of the original application, a note is made pertaining to the possibility of a subsequent application for an endorsement or special certificate, only the missing confirmations required for that endorsement need be submitted with the later application, provided a copy of the original authorization signed by the WAZ manager is enclosed.

Decisions of the *CQ* DX Awards Advisory Committee on any matter pertaining to the administration of this award will be final.

All applications should be sent to the WAZ Award Manager, W4KA, after the QSL cards have been checked by an authorized *CQ* checkpoint.

Zone maps, printed rules, and application forms are available from the WAZ Award Manager. Send a self-addressed envelope, 4" × 9½" with 28¢ postage, or a self-addressed envelope and 2 IRCs. For rulings on borderline areas, consult the WAZ Award Manager.

SINGLE-BAND WAZ

Since January 1, 1973, WAZ awards have been issued to licensed amateur stations presenting proof of contact with the 40 zones of the world on one of the five high-frequency bands, 80-10 meters. Contacts for a single-band WAZ award must have been made after 0000 hours GMT, January 1, 1973. Proof of contact shall consist of proper QSL cards checked by the DX Editor, the WAZ Manager, or an authorized *CQ* checkpoint. Single-band certificates will be awarded for both two-way phone, including SSB, and two-way CW. The single-band WAZ program is governed by the same rules and uses the same zone boundaries.

5-BAND WAZ

On January 1, 1979, the CQ DX Department, in cooperation with the CQ DX Awards Advisory Committee, announced the 5-band WAZ.

Applicants who succeed in presenting proof of contact with the 40 zones of the world on the five high-frequency bands—80, 40, 20, 15, and 10 meters (for a total of 200)—will receive a special certificate in recognition of this achievement.

These rules were in effect as of July 1, 1979, and supercede all other rules. Five-band WAZ will be offered for any combination of CW, SSB, phone, or RTTY contacts, mixed-mode only. Separate awards will not be offered for the different modes. Contacts must have been made after 0000 hours GMT, January 1, 1979. Proof of contact shall consist only of proper QSL cards checked by the WAZ Award Manager, W4KA. The first plateau will be a total of 150 zones on a combination of the five bands. Applicants should use a separate sheet for each frequency band, using *CQ* form 1479.

A regular WAZ or single-band WAZ will not be a prerequisite for a 5-band WAZ certificate. All applications should show the applicant's WAZ number.

After the 150-zone certificate is earned, the final objective is 200 zones for a complete 5-band WAZ. *CQ* is donating plaques for the first 5 winners, after which the applicant will have a choice of paying a fee for his plaque and/or applying for an endorsement commemorating this achievement.

The applications should be sent to the WAZ Award Manager, W4KA. The 5-band award is governed by the same basic rules as for the regular WAZ and uses the same zone boundaries.

THE WPX AWARD

The *CQ* WPX award recognizes the accomplishments of confirmed QSOs with the many prefixes used by amateurs throughout the world. Separate distinctively-marked certificates are available for 2 × SSB, CW, and mixed modes, as well as the VPX award for shortwave listeners and the WPNX award for Novice amateurs.

All applications for WPX certificates (and endorsements) must be submitted on the official application form *CQ* 1051A. This form can be obtained by sending a self-addressed stamped envelope to the WPX Award Manager, Bob Huntington K6XP, 5014 Mindora Dr., Torrance CA 90505. It is highly desirable to use business-size envelopes, 8½" × 11", for this purpose.

All QSOs must be made from the same country. All call letters must be in strict alphabetical order and the entire call must be shown. All entries must be clear and legible.

Certificates are issued for the following modes and numbers of prefixes (crossmode QSOs are not valid for the CW or 2 × SSB certificates): mixed (any mode)—400 prefixes confirmed; CW—300 prefixes confirmed; 2 × SSB—300 prefixes confirmed. Separate applications are required for each mode.

Cards need not be sent but must be in the possession of the applicant. Any and all cards may be requested by the WPX Award Manager or by the *CQ* DX Committee. The application fee for each certificate is $4.00 for subscribers and $10.00 for non-subscribers, or the equivalent in IRCs. All applications and endorsements should be sent to the WPX Award Manager.

Prefix endorsements are issued for each 50 additional prefixes submitted. Band endorsements are available for working the following numbers of prefixes on the various bands: 1.8 MHz—50; 3.5 MHz—175; 7 MHz—250; 14 MHz—300; 21 MHz—300; and 28 MHz—300. Continental endorsements are given for working the following numbers of prefixes in the respective continents: North America—160; South America—95; Europe—160; Africa—90; Asia—75; and Oceania—60. Endorsement applications must be submitted on *CQ* form 1051A. Use separate applications for each mode and be sure to specify the mode of your endorsement application. For prefix endorsements, list only additional call letters confirmed since the last endorsement application.

A self-addressed envelope and $1.00 or 5 IRCs are required for endorsement stickers.

The two or three letter/numeral combinations which form the first part of any amateur call will be considered the prefix. Any difference in the numbering, lettering, or order of same shall constitute a separate prefix. The following would be considered different: W2, WA2, WB2, WN2, WV2, K2, and KN2. Any prefix will be considered legitimate if its use was licensed or permitted by the governing authority in that country since November 15, 1945.

A suffix would designate portable operation in another country or call area and would count only if it is the normal prefix used in that area. For example, K4IIF/KP4 would count only if it is the normal prefix used in that area. For example, K4IIF/KP4 would count as KP4. However, KP4XX/7 would not count as KP7 since this is not a normal prefix. Suffixes such as /M, /MM, /AM, /A, and /P are not counted as prefixes. An exception to this rule is granted for portable operation within the issued call area. Thus, contacts with a special prefix such as WS2JRA/2 count for WS2; however, WS2JRA/3 would count for W3.

All calls without numbers will be assigned an arbitrary Ø plus the first two letters to constitute a prefix. For example, RAEM counts as RAØ, AIR as AIØ, UPOL is UPØ. All portable suffixes that contain no numerals will be assigned an arbitrary Ø.

For example, W4BPD/LX counts as LXØ and WA6QGW/PX counts as PXØ.

THE VPX AWARD

The VPX, or verified prefixes award, can be earned by shortwave listeners (SWLs) who possess QSL cards confirming reception of at least 300 different amateur prefixes. No mode endorsements are available. Applications are submitted to the WPX Award Manager in accordance with the WPX rules.

THE WPNX

The WPNX award can be earned by USA Novices who work 100 different prefixes prior to receiving a higher-class license. The application may be submitted after receiving the higher license, providing the actual contacts were made as a Novice. Prefixes worked for the WPNX award may later be used for credit toward the WPX award.

The rules for the WPNX award are the same as for WPX, except that only 100 prefixes must be confirmed and that applications are sent to the WPX Award Manager.

THE *CQ* DX AWARD

The *CQ* CW DX award and *CQ* SSB DX award are issued to any amateur station submitting proof of contact with 100 or more countries on CW, or SSB. Applications should be submitted on the official *CQ* DX award application.

All QSOs must be 2-way SSB or 2-way CW—crossmode or one-way QSOs are not valid for the *CQ* DX awards. QSLs must be listed in alphabetical order by prefix and all QSOs must be dated after November 15, 1945. Except for the mobile endorsement, all QSOs must be made from the same call area.

QSL cards must be verified by one of the authorized checkpoints for *CQ* DX awards or must be included with the application. If cards are sent directly to the Award Manager, Billy Williams N4UF, 911 Rio St. Johns Dr., Jacksonville FL 32211, postage for their return by first-class mail must be included. If certified or registered mail return is desired, sufficient postage should be included.

Country endorsements for 150, 200, 250, 275, 300, 310, and 320 countries will be issued. To promote multiband usage and special operating skills, special endorsements are available as follows:

- a 28-MHz band endorsement for the 100 or more countries confirmed on the 28-MHz band;
- a 3.5/7-MHz band endorsement for 100 or more countries confirmed using any combination of the 3.5- and 7-MHz bands;
- a 1.8-MHz band endorsement for 50 or more countries confirmed on the 1.8-MHz band;
- a QRPp endorsement for 50 or more countries confirmed using 5 Watts input or less;
- a mobile endorsement for 50 or more countries confirmed while operating mobile. The call area requirement is waived for this endorsement;
- an SSTV endorsement (*CQ* SSB DX award only) for 50 or more countries confirmed using 2-way slow-scan TV;
- an OSCAR endorsement for 50 countries confirmed via amateur satellite.

A fee of $4.00 for subscribers and $10.00 for non-subscribers (or the equivalent in IRCs), to defray the cost of the certificate and handling, is required for each award. An SASE or one IRC is required for each endorsement.

The ARRL DXCC country list constitutes the basis for *CQ* DX award country status. Deleted countries will not be valid for the *CQ* DX award. Once a country has lost its status as a current country, it will automatically be deleted from our records.

All contacts must be with licensed land-based amateur stations working in authorized amateur bands. Contacts with ships and aircraft cannot be counted.

USA-CA AWARD PROGRAM

The United States of America Counties award, sponsored by *CQ*, is issued for confirmed contacts with specified numbers of US counties under rules and conditions hereafter stated.

The USA-CA is issued for seven (7) different classes, each a separate achievement as endorsed on the basic certificate by the use of a special seal for each higher class. Also, special endorsements will be made for all-one-band or -mode operations subject to the rules.

Class USA-500 requires 500 counties, USA-1000 requires 1000 counties and 25 States, USA-1500 requires 1500 counties and 45 states, USA-2000 requires 2000 counties and 50 states, USA-2500 requires 2500 counties and 50 states, USA-3000 requires 3000 counties and 50 states, and the ultimate award, USA-3074-CA, is issued for all 3074 counties in all 50 states. The USA-3074 awardee is given a special honors plaque for a cost of $35.

USA-CA is available to all licensed amateurs everywhere in the world and is issued to them as individuals for all county contacts made, regardless of calls held, operating QTHs, or dates whatever. Special USA-CAs are also available to SWLs on a heard basis.

All contacts must be confirmed by QSL and such QSLs must be in one's possession for identification by certification officials. Any QSL card found to be altered in any way disqualifies the applicant.

For mobile and portable operations, the postmark will identify the county unless information stated on QSL cards makes other positive identification. In the case of cities, parks, or reservations not within counties proper, applicants may claim any one of the adjoining counties for credit (once).

The USA-CA program will be administered by a *CQ* staff member acting as USA-CA custodian, and all applications and related correspondence should be sent directly to him at his QTH. Decisions of the custodian in administering these rules and their interpretation (including future amendments) are final.

The scope of USA-CA makes it mandatory that special record books be used for application. For this purpose, *CQ* has provided a 64-page, 4¼" by 11" record book which contains application and certification forms and which provides record/log space meeting the conditions of any class of award and/or endorsement required.

A completed USA-CA record book constitutes the medium of basic application and becomes the property of *CQ* for record purposes. On subsequent applications for either higher classes or for special endorsements, applicants may use additional record books to list required data or may make up their own alphabetical lists conforming to requirements.

Record books can be obtained directly from *CQ*, 76 N Broadway, Hicksville NY 11801 for $1.25 each. We recommend that two be obtained: one for application use and one for personal file copy.

To apply, make the record book entries necessary for county identity and enter other log data necessary to satisfy any special endorsements (band/mode) requested.

Be sure to have the certification form provided signed by two licensed amateurs (General class or higher) or an official of a national-level radio organization or affiliated club, verifying that QSL cards for all contacts as listed have been seen. The USA-CA custodian reserves the right to request any specific cards to satisfy any doubt whatever. In such cases, applicants should send sufficient postage for return of cards by registered mail.

Send the original completed record book (*not* a copy), certification forms and handling fee. The fee for non-subscribers to *CQ* is $10.00 or 40 IRCs; for subscribers, the fee is $4.00 or 12 IRCs. *CQ* subscribers should include a recent mailing label with their application (or copy). Send to USA-CA Custodian, Ed Hopper W2GT, Box 73, Rochelle Park NJ 07662. For later applications for higher class seals, send the record book or a self-prepared list (per rules) and $1.25 or 6 IRCs (handling charge). For application for later special endorsements (band mode) for which certificates must be returned for endorsement, send certificates and $1.50 or 8 IRCs for handling charges. Note: At the time any USA-CA award certificate is being processed, there are no charges other than the basic fee, regardless of the number of endorsements or seals; likewise, one may skip the lower classes of USA-CA and get higher classes without losing any lower awards credits or paying any fee for them.

SALMON-A-RAMA

The Racine Megacycle Club will be operating W9UDU, a special event station, during SALMON-A-RAMA from July 10th through July 18th, 1982. Operating dates and times: July 10, 11, and 17—1100Z-2300Z; July 18—1100Z-2000Z. Frequency: Fish locators have identified good fishing grounds in the General portion of the phone

bands on 10, 15, and 20 meters. Go fishing for W9UDU and receive a special QSL for an SASE to: W9UDU Racine Megacycle Club, c/o American Red Cross—Lakeshore Counties, 4521 Taylor Avenue, Racine WI 53405.

For more information, contact David Voss WB9USI, President, Racine Megacycle Club, 3333 Standish Lane, Racine WI 53405.

WAPAKONETA OH

The Reservoir Amateur Radio Association will operate K8QYL from 1300Z July 17 to 0400Z July 18 and again from 1300Z to 1900Z, July 18, from the birthplace of Neil Armstrong, the first man on the moon. Frequencies: phone—3940, 7260, 14285, 21360, and 28590, plus or minus QRM; CW—50 kHz up from the bottom of the band at the beginning of the odd hours. Check-ins invited on K8QYL/R (147.93/147.33). Certificate for QSL and SASE to: K8QYL, PO Box 268, Ceilna OH 45822.

TOM SAWYER DAYS

The Hannibal Amateur Radio Club, Inc., will issue a second annual special certificate from the National Tom Sawyer Days celebration in Mark Twain's boyhood home town, Hannibal, Missouri, on July 3-4, 1982. Hours: 1500-2100 UTC both days. Frequencies: phone—7.245, 14.290, 21.400, and 28.700; CW—7.125 and 21.125 MHz. The club will also be observing our 50th anniversary. Help us celebrate! To receive the certificate, send a large (8"×10") SASE and your personal QSL card confirming the contact to the Hannibal Amateur Radio Club, Inc., WØKEM, 2108 Orchard Avenue, Hannibal MO 63401.

BONFIELD IL

Commemorative amateur radio station K9JLK will be operating from the Bonfield, Illinois centennial celebration from 1300Z, July 4, 1982, through July 5. Operating frequencies will be 223.50, 144.250 (SSB), 146.520 (FM), 50.115, 28.600, 21.400, 14.325, 7.275, and 3.8-3.9. For QSL, send an SASE to Jerry Whalen WB9WOC, RR 2, Kankakee IL 60901.

WINONA MN

The Winona (MN) ARC will operate WBØNIU on July 3 to commemorate the 125th anniversary of the signing of the charter of the city of Winona. Winona is a river town in SE MN. The station will operate from 1500Z to 2100Z on 7.245, 14.290, 21.365, and 28.650 MHz. A special QSL for working this station will be available by SASE to Erik W. Brom WBØNIU, 3655 6th St., Winona, MN 55987. Other area stations will also be using these cards.

CELINA OH

The Reservoir Amateur Radio Association will operate W8DN from 1300Z to 1800Z, July 24, from the courthouse lawn during the Celina Lake Festival. Frequencies: phone—3940, 7260, 14285, 21360, 28590, plus or minus QRM. Check-ins are invited on WB8FNB/R on 146.01/146.61. Certificate for QSL and SASE to W8DN, PO Box 268, Celina OH 45822.

LETTERS

KB7NW A WINNER

I would like you to know that the article "Pacific Odyssey" by KB7NW was one of the best I have read in a long time. I thought the way it was organized and presented was topnotch, as was the use of photographs to supplement the excellent story line. I could almost feel I was there!

If you give awards for well-presented articles, J.D. Binders' "Pacific Odyssey" to Kingman and Palmyra sure get my vote!

This article is a credit to your magazine.

Homer Lasitter W6QX
La Jolla CA

We're glad you liked "Pacific Odyssey," Homer. And thanks for writing. Not only will the author enjoy your comments, the 73 staff appreciates the feedback. We encourage readers to let us know when they particularly like (or dislike) something in 73.—N8RK.

NO NUKES—I

I am a firm believer in our First Amendment rights, but I take issue with the basic premise of the May, *73*, article, "Surviving the Unthinkable." Yes, I agree that hams have a responsibility to be prepared for emergencies, but nuclear war IS unthinkable. There would be NO survivors. Preparing for a nuclear holocaust assumes there must be one, and that attitude just might help it happen. Hams should not give in—we must fight for our right to a life of peace.

David Stoft WD6DXX
Spokane WA

NO NUKES—II

I am upset by the "Surviving the Unthinkable" article in your May, 1982, issue, for several reasons. A sense of practicality plus the firm grasp on Murphy's Law which most amateurs have should reveal the weaknesses of the FEMA claims for how we shall evacuate. Missiles take only 30 minutes to arrive, and it will take far longer for all those in target areas to depart. To hope for any better circumstances is to hope that one's new antenna installation is going to go in without a hitch. Wishful thinking will not hack it.

True, amateurs can help in almost any emergency, but I feel that all amateurs should be burning the airwaves *now* to try to talk to anyone anywhere on the planet to forward the goal of preventing "the unthinkable." To cheerfully accept ten million deaths is insanity, no matter what the format!

I sense that this is another "Gee, gosh, we can be so helpful" article. I do not want to be in the position of trying to provide emergency service to what would be left. I would rather work now at some other solution to the problem than get first-hand experience on how Murphy would operate with nuclear weapons as tools of his "whatever can go wrong, will" policy.

Amateurs have a unique ability to speak to peoples of other countries. Let's use that ability to forward efforts to prevent a nuclear conflict, rather than become another vulture watching over a possibly dying America as a part of this government's new Civil Defense push.

David Gibbons
Carmichael CA

BASH REHASH

Concerning the ongoing Dick Bash story, I'd like to add another log to the fire.

When's the last time you sat back in your favorite chair with a copy of *QST*'s Q & A manual? Unless you're sitting on a bed of nails with five kids screaming around you and the TV set too loud, within a few minutes after opening the front cover, you'll be checking the insides of your eyelids for holes. In short, it's more boring than a monotonous voice telling you last week's news.

The questions in that venerable manual are not quite the same as found on the FCC tests, but then again, if you look closely, they're not all that much different, either. The tricky part is trying to wade through what is termed an answer without having to reread it many times. By then, your attention and patience are wearing thin. After a few pages of this you begin to wonder if it's worth it. Those of stout heart and strong desire may make it just a bit further, but eventually the book is closed and gathers dust. The *Ameco Study Guide* is not quite as bad as it lays out the explanation without so much fairy dust sprinkled on it. If you haven't had the time to look over one of Dick Bash's books, he does give the test question and the test answer, but it doesn't just stop there. It explains why that is the correct answer and does it with enough literary flair to keep your interest to the point of making a more lasting impression.

For several years in the Army, I taught basic electricity and aircraft electrical systems to servicemen who not only didn't want to be there, but some of them shouldn't have even been there to begin with. Vietnam caused some barrel scraping near the end. How do you teach people like that? You create an atmosphere or situation that captures their interest. It wasn't easy and most instructors didn't even try, but when you succeeded you knew it and the students

knew it, too. I was also partly responsible for writing tests and lesson plans. My approach was somewhat similar to Dick's although greatly restricted due to bureaucratic regimentation.

Have you ever met Dick Bash? He's outgoing and congenial but a bit of a maverick, like most people who create or lead. He saw a weakness in the self-tutorial method of teaching a complex subject that was sorely lacking in instructional material that filtered out the black boxes, witches, and demons. There are those in this world who consider electronics as "black magic" and some of them are hams. Basic electricity, if taught properly, can be interesting and informative. If college courses are offered for electronics, how does the average person expect to learn it without some help?

Letters to editors are strange things. This is my first and probably last one. Every subscriber gets to read the editorial—which is really only one man's opinion—and the mass is left to draw its own conclusions but based only on the editorialized facts. The editor may consider it his prerogative to tell it the way he sees it, and who's to dispute it? I feel you were wrong to so vehemently condemn Dick Bash as you did and not give everyone the facts of what the book is really like. I've met Bash class graduates and find them no different from hams I met 10 or 15 years ago. We need to increase and strengthen our numbers and I don't feel one bit like we're compromising ourselves with Dick's books.

I can almost understand *QST* not wanting to run his ads. After all, a "non profit" organization in the publishing business with a corner on most of the "instructional material" has to protect its own interests. Doesn't it? What all this boils down to is this: Whether you consider the Dick Bash books unethical or not, they get the job done of informing and teaching. Even my wife learned enough to evoke a response of, "So that's how it works!" I'm not going to fault Dick's system one bit because it works. What I do fault is your remarks of "poison" and "being insidious" without ever telling what the books are like and letting people draw their own conclusions. I would expect that of a rag like the *National Enquirer*, but not from *73 Magazine*.

Fred Palmer WA5WZD
Corinth TX

Have I met Bash? Heck, Dick worked for us here for a while. He drove us crazy and we gave up trying to harness him. We parted good friends and I think stay that way. Dick knows what I think of his "system" and why.

The Bash approach does give some slight attention to explanations, but the brunt of his books is to present, word for word, the questions you are going to face... and their answers. The one-day intensives are designed to fill your short-term memory with the questions and answers, not long-term real understanding of electronics and radio. If you are unable to take the FCC test the next day after an intensive by Bash, you can be in deep trouble.

One of the more serious disasters of our whole educational process has to do with the continued use of short-term memory for the passing of tests instead of getting the information into the long-term memory. This is why so many students have little recollection of a course once they have passed it. This was my major gripe with college, where the emphasis was on read-and-take-a-quiz, with little effort to discuss the material and thus give it a chance to be understood and filed away in more permanent memory.

The Navy, on the other hand, had a fantastic course in electronics, where they taught theory and then immediately took you into a lab to work with that theory and thus grow to really understand it. In classes, we discussed the theory until we were able to think in electronic terms. If I'm able to get a college started, it is going to teach the students to think, not memorize. They are going to learn about electronics and then work with it. They will learn about communications and then learn to design, build, and service equipment. They will learn computer design... and repairs. They will learn to write programs and fix 'em.

It may be that amateur radio has so fallen apart under the pressures to let in one more friend or wife that it no longer is even considered important for hams to understand radio. If so, we should formally agree with this and throw away our charter, section 97, and put amateur radio and CB together into one service, being honest about our motives.

Fred, when I suggest that hams get mad about this and rush to their neighborhood ham store and rip Bash's cheat books to shreds, I know... as do you, if you think about it instead of reacting... that what will happen is a rush to buy these short cuts to getting a ticket. They do work. It is now possible to get a ham ticket without really knowing a damned thing about electronics or radio. People with a knack for the code can learn it enough to pass the test in about one hour. That's how long it took me to get to 5-wpm solid copy right from not knowing a single character.

If it's easy ham tickets you want, Fred, you've got 'em now. But I don't see that bringing in many hams. Hell, we can't even give ham tickets away these days. Now, I may be wrong about wanting hams to clean up the act... to get our clubs to start teaching the fundamentals of theory and making sure that newcomers qualify. Most of my mail says I have a lot of hams backing me, but there are opponents such as you.

Perhaps we are still being too strict in our tests. One could certainly make a case for the amateur tests being biased so that they exclude blacks, women, Chinese, Latin-Americans, and other such groups. Perhaps it is time for a move toward affirmative action and an open-door policy for these under-represented groups. Should we start seeing how simple we can make the procedure in order to give these minorities (and the female majority) their "rights"?—Wayne.

NO MISTEAK HERE

This letter is in reference to FCC spokesman Vernon Wilson's denial of misspellings on FCC code tapes (page 121, *73*, May, 1982).

Over the last few years I have taken one General class test and two Extra class tests (one failed because of nerves and pressures and one passed with 100% a month later). I found these tests to be difficult. However, there were no misspelled words, irregularities, or even sneaky tricks. I even had Springfield on one (spelled correctly). Interestingly, one fellow told me after the test that he had copied Springvale; another had copied Springdale.

Under the extreme pressure we hams generate within ourselves at test time, I believe it is quite possible to sincerely, but incorrectly, copy "mistakes" that simply are not there.

Lincoln Thorner KS2H
New York NY

KS2H's letter is like several others we have received. No one has come forward with documented evidence of a misspelling on the FCC code exams.—N8RK.

BRAINS NOT FISTS

I have here in front of me the March issue of *73 Magazine*, but what I want to talk about is not how much I like it but your stand concerning the requirement for the Morse-code test.

There should be no question but that in this day and age of space exploration and digital electronics, this requirement is pathetically antiquated and comparable to requiring Greyhound drivers to know how to handle a Conestoga wagon. It serves no purpose other than to keep away from amateur radio technically competent people who have neither the patience nor the time to waste in learning a skill that has no place in state-of-the-art electronics.

All of the surveys that showed "overwhelming opposition" to a no-code license have been performed with no objectivity and a lot of bias in a group of individuals who had a vested interest in the outcome. Nobody should be a part of, or a judge in, a contest of any kind who thinks: "What? A no-code license? Over my dead body! Let them sweat it out as I did!" You don't have to be endowed with divinatory powers to know beforehand the outcome of such a survey. In other words, newcomers not welcome!

Keep up the good work and be sure that once again we will see in the future who was right. What we need today is brain, not fist! Your suggestion to use technical knowledge as a filter, instead of Morse-code skill, does make a lot of sense.

Oh, by the way, let me tell you that I am not a frustrated would-

be ham who flunked the code test. Many years ago, more than I care to remember, I had to get a commercial second-class radio operator's license (including Morse at 20 wpm), and to this day I fail to see what good can come to amateur radio by turning the code skill into a fetish.

It is about time that some common sense is written into these regulations.

Paulo G. Lefevre
PY1AQL/CT1EM
Carcavelos, Portugal

Olé.—Wayne.

HORSERADISH DISPLAY

I've been fascinated by QSL cards since I was an SWL in the early 1950s. A QSL is a special thing—representative of the individual, locale, and country of origin. I am quite aware of the expense involved, be it the simplest "Quick Print Shop" shot of a hand drawing or the elaborate five-run or color photographic rendition.

The thing that moved me to write this letter is the volume of cards seen since become a DX QSL manager (CE5BYY). Gentlemen—the ladies are now left out, they do it right—the blotter paper and repetitiously inane renderings passing this way don't even rate a shoe box as a repository. As a person driving up in an unwashed, beat-up automobile makes a lasting first impression, so do your cards.

It pains me to see that cards from the South Pacific that ten short years ago had swallowtail butterflies, birds of paradise, and outrigger canoes now look like the cards of members of the Southern California DX Club. How many cards can a person with DXCC, WAZ, and God-knows-what-all possibly send? Economy seems to rule, however, and I would offer the following comments.

1. Lack of return postage is a paramount issue as it makes the card expense critical.

2. The card's free, the freight ain't.

3. If you care and really have had at least one original thought in your life, consider the fact your card represents *you*, so do it cute, professionally, or at least in good taste and design.

If you're tired of seeing your country QSL display looking like horseradish and mustard, the solution really rests with you and the merchants of mediocrity who simplify the continuation of the problem. The DX is really waiting for you to get your act together.

Terry F. Staudt WØWUZ
Evergreen CO

Readers who don't like horseradish are encouraged to submit a QSL card to 73's monthly contest. You will find details with this month's winner.—N8RK.

DX FOR THE BLIND

Two years after losing my sight from detached retinas, I obtained my Novice class license. Six months later, I achieved General class status and have been a DXer ever since. Two common problems for the blind DXer are the inability to obtain current DX information and the difficulty of filling out DX cards.

I am writing this letter to inform blind DXers of a new and exciting service. The Braille DX Service provides: (1) a monthly cassette recording of current DX activity and expeditions, as well as important QSL information, and featuring the Kansas DX Association monthly newsletter, (2) a current DXCC countries list in Braille or on cassette tape, including regular up-to-date prefix changes, and (3) a personal QSL manager for outgoing cards. Volunteers fill out the blind DXer's QSL cards, and log information is passed, either by on-the-air schedules or simply by mailing the information direct to the volunteer. Log information can be recorded on cassette tape and mailed to the volunteer.

Membership is simply a one-time $2.00 donation to help purchase blank cassette tapes for the monthly newsletter. The Kansas DX Association has demonstrated their interest in this program by providing a cassette recording of the monthly newsletter and volunteer QSL managers for the blind DXer.

Phil Scovell AFØH
Lakewood CO

3 CHEERS FOR MFJ

I want you to know about an experience I had with one of your advertisers. Two years ago at the Atlanta Hamfest I purchased an MFJ-962 antenna tuner. Well, as you might know, I probably loaded it wrong and blew a small coil in the swr bridge circuit. I called them on their WATS line, and it was not until later that I read down the page a bit and saw that I had called the sales number and not the parts and service department. A very pleasant YL answered and, not understanding what I wanted to order, she connected me to an OM by the name of Stan. I explained to Stan that I had blown the coil, that the unit was out of warranty, and that I wanted to order another. Well, a strange thing happened for these times, as Stan refused to sell me the coil; instead, he insisted that I give him my name and address and he would get one out to me in the mail. . . at *no charge*! Now that is what I call darn good business PR.

It was not so much the cost (or in this case, non-cost) as it was the pleasant manner in which this was handled, and I would appreciate it if you would let your readers know about one of the "good guys"—MFJ Enterprises of Mississippi State, Mississippi.

Don Williams Sr., Publisher
68 Micro Journal
Hixson TN

HAM PEACE CORPS

In your *73* issue of November, 1981, I saw your editorial about South Africa and would like to record my disapproval of your visit to the Republic of South Africa.

South Africa is the only remaining country which violates human rights on the basis of race (skin pigmentation). This violation is perpetual and cannot be transcended (because you cannot change your color) and is grossly unfair to its people and the people of the world (because such ideas might spread out of South Africa to the rest of the world again). Therefore, it is necessary to fight such an unfair system by all means, including withholding technology, sports contacts, amateur radio contacts, etc.

Why? Because the racist minority in power (which does *not* include all South African whites) can use such technology to oppress the majority and international sports and cultural contacts to win international acceptance and legitimacy. Building up communication technology through amateur radio is one such example—communication technology can be used to spread ideas of apartheid and for police and military purposes.

You might say, sure, South Africa violates human rights, but what about other dictatorial regimes in Africa/South America/Asia? There, oppression is through ideology (belief systems) or money (class background of a person), etc., and boycott action against them is valid and is practiced, e.g., against Chile, Poland, etc. The only similar case is the caste system, as it is practiced in the feudal and backward areas of India—where you are born into a caste and are discriminated against.

As a citizen of a multi-racial democracy (the same as in your case) where people of various races (Caucasian, Mongolian, and Negroid) live in harmony, settle, and marry across regions and are guaranteed the same constitutional rights, I think it is our duty to discourage contacts with South Africa.

Right now, the Republic of South Africa is involved in a PR campaign (albeit the organization of such a campaign may well be loose) and is trying to get scientists, scholars, and sportsmen to visit them (e.g., UK cricket players, Taiwanese scholars, etc.). Clever as they are, they sent Dr. Christian Barnard (the famous heart surgeon and a believer in racism) to India, knowing that he would be the least objectionable here.

I respect *73* for its boldness (in criticism of regulatory bodies), its presentation (which is lucid and interesting), and its keeping abreast of new technology, and this is the very first time I feel the urge to express my disapproval. I hope that you will take it in a constructive spirit and respond to my arguments.

Gopal Kamat VU2JE
Bombay, India

Well, Kamat, just in case there are some readers who agree with your thinking, it might be prudent to answer your criticisms. Let's go back a few years to the time when the US was involved with Vietnam. Recall with me, if you will, that my country was being severely criticized by much of the world. Many people were busy not visiting the US be-

cause it was involved in that unpopular war.

Possibly, Kamat, you were not a reader of 73 during those years. If you had been you would know that there were a number of Americans who were not in favor of the war. Some reacted by being completely negative about it...just get out and leave 'em alone. Others recognized the problems involved, but felt that there was more than one way to respond. Indeed, I made a trip around the world and talked with hams in many countries about the situation. As a result, I developed a plan which I felt was far better than fighting. I distilled the ideas I ran into in Yugoslavia, Thailand, Singapore, and New Caledonia as I talked with hams in these countries.

My plan seemed relatively simple, workable, and most likely to result in avoiding further bloodshed. I am convinced that if the US had followed it that a unified Vietnam would be free of communism...as would Laos and Cambodia. I wrote of my plan in 73 and got hundreds of letters supporting it. I also sent it to Congress, but as far as I know not one copy ever got through the assistants. I failed ...but at least I tried.

Now, about South Africa. Sure, many people are at odds with the South African government. But does that mean that we have to hate South Africans? What possible benefit is that to anyone? I went to South Africa to visit the hams and computer fanatics, not the government. As a matter of fact, I don't think I met anyone from the government.

The people that I did meet and talk with are as helpless about the policies of their government as I was about mine. They, sadly, have far less freedom to speak up in criticism...but then there are very few countries which are as permissive as the US. And remember, please, that there are some government agencies in the US which will not permit open criticism. Our country is good in many ways, but it is far from free as yet.

May I contrast your negative attitude with my positive one. You advocate not visiting countries of which you disapprove. I advocate visiting them and advocating changes to them which will improve the situation. Indeed, while I was in South Africa I went on television during prime time and said flat out that it was time for them to consider making some moves to change their basic policies. I am told that over a million blacks and whites saw my broadcast.

I think I got their attention when I put it this way...I explained that there are about 59 countries in Africa and that approximately 58 of these hate South Africa. I suggested that perhaps it was time to start doing something to counter this ...and I had a positive suggestion, not a negative one.

As I pointed out, we are entering an electronic age. Computers and telecommunications are inseparable with the future. I also pointed out that unless South Africa did something... and quickly...the country would be passed by in technology. To keep up with the need for people to invent, build, operate, and service the technology of the future, they are in need of tens of thousands of technicians and engineers.

The only reasonable source of this many technical people will be for South Africa to make it a policy to introduce amateur radio and computer clubs in their high schools. They will have to get teenagers interested in technical careers.

Okay. The next step is an obvious one...the need for technical colleges to bring these interested teenagers up to the state-of-the-art in electronics, communications, and computers. This can be done either the expensive way...by the government paying for it...or it can be done by getting private industry to pick up most of the tab. I suggested they consider my plan for opening a college which is integrated with several local electronics businesses. In this way, the students would get the best of the formal technical education...and the practical professional experience of working with a business firm.

Further, I proposed that they include plenty of business courses so that the students would be well rounded in both technical matters and business. I suggested that they teach advertising, writing, speaking, finance, hiring, personnel management, purchasing, and so on.

The income from working with the on-campus firms would keep the end cost of the education low and within the reach of most middle-income families.

Then, once this idea had sunk in, I proposed what my interviewer called the Electronic Peace Corps. This was a plan to bring in worthy students from the other African counties for a free education in this new type of school. The cost would be low and the students, once they returned to their native countries, would soon rise to the top by virtue of their education and experience.

The people in the other African countries realize that they have no opportunity for a good education unless they leave their country. At present, the only sources for a free education lie in Moscow and Havana. These are not very attractive alternatives. Further, the people in these countries realize that they are on a downward spiral, something which only an infusion of educated people can change.

The courses in South Africa would not, at first, be very popular because of the hatred. But something as valuable as that for nothing might overcome all sorts of emotional blocks. South Africa would have to see that the black students were treated fairly and given the best of educations. I think the floodgates would open and eager students would come in from all over Africa.

It will take a long time to change Africa...but isn't it time to get started? There are tremendous resources in Africa ...with plenty of country for farms, millions of educable people, and nowhere to go but up. Yes, there are tremendous obstacles. I've been there and seen them. I've talked about them with ham friends in many of the African countries. We're looking at several generations before things are really changed.

But with educated entrepreneurs in more and more African countries it could be possible to stop the destruction of these countries by their despot leaders and to start working for their eventual strength.

Isn't it better to visit a country and make a try at doing something to help change things? The thousands of people who have not visited South Africa have done nothing. It may be that my voice has been completely lost...but I did try.—Wayne.

REVIEW

ICOM IC-4A 440-MHZ HT

I recently purchased an Icom IC-4A 440-MHz hand-held FM transceiver because I wanted to get on the FM portion of the 3/4-meter band in the most cost-effective manner possible. I wanted to move up from the Motorola T-44, which lacks frequency stability and is quite large and heavy. I believe that I made a very good decision and if you'll read on, I'll be glad to tell you why.

First, I decided that my next rig would be new. With a unit straight from the factory, you get some kind of a warranty—at least saying that it will work right from the start. (Everything that I ever bought used always had something wrong with it.) Usually one faces a minor thing such as a noisy volume control or a worn-out switch. But if it is an intermittent problem that wants to be hard to trace down, may God help you! Also, when people sell their old gear they seem to want almost what they paid for it way back when. This is good salesmanship, I suppose, but I'd rather spend the extra bucks for state-of-the-art and a warranty.

No Crystals

Second, I decided that the rig would be synthesized. Activity on 440 is growing as more and more of the two-meter-FM crowd are getting one of the current crop of 70-cm FM hand-held units (Icom IC-4A, Yaesu FT-708R, Tempo S-4, Santec ST-440/up). Therefore, more repeaters are bound to appear.

Transmit and receive crystals of the high-accuracy (HA) vari-

Photo A. The IC–4A hand-held 440-MHz FM transceiver. (Photo by Michael D. Landis)

ety go for just over thirteen dollars a copy (anything less just doesn't make it). After a one- to two-week wait, the crystals arrive, and after installing them in the radio, you get to adjust those tiny trimmer capacitors until you are exactly on frequency. Also, the price of twenty crystals, as an example (ten for transmit and ten for receive), times thirteen dollars each comes to $260, which is about what I paid for my IC-4A.

The IC-4A offers 2000 possible channels—the top 10 MHz of the 420-to-450-MHz band, in 5-kHz steps. The thumbwheel switches select the frequency in 1-MHz, 100-kHz, and 10-kHz steps, with the 5-kHz select switch just to the right of the thumbwheel switches. (The switch at the extreme right is not used by Icom—it is there for you to wire up a switchable tone encoder.)

The antenna connector is a BNC type, and below it are external microphone and speaker jacks. To the right of the antenna connector is an LED which lights during transmit. It also serves as a battery indicator; if it goes out while you are squeezing the push-to-talk switch on the left side of the radio, your battery has just died. (You can, as soon as you notice the LED go out, immediately unkey, then key up again and say rapidly, "This is [your callsign]—clear," if this makes you feel better. You may even get through. If not, the next person in line will probably sign you out.)

On the back of the radio are three slide switches. The rf power switch, which is the top one, selects between .15 Watts out in the low position and 1.5 Watts out in the high position. In the low-power position, you draw only 43% of the current that you do in the high position, so you can transmit about twice as long. But remember that you're putting out only one-tenth the power. I do not consider this to be a good enough trade to warrant the use of the low-power position unless I am within spitting range of a repeater.

Below the power-select switch is a duplex/simplex select switch, and below that is a +5-MHz/−5-MHz transmit offset switch. Don't ask me why Icom does not use a single three-position switch that has 5 down, simplex, and 5 up on it. My IC-4A does not have an out-of-band transmit-inhibit circuit in it since the HT will transmit

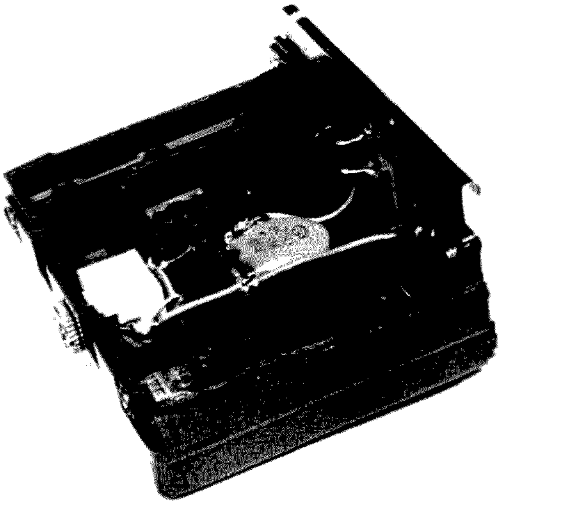


Photo B. The regulator circuit in the BP-4 case. (Photo by Michael D. Landis)

from 435.000 MHz to 454.995 MHz when in the duplex mode.

The microphone is located on the front of the radio case to the bottom right of the speaker, just above the word "microphone" that is molded onto the case. I was so used to those CB-type hand-helds where the speaker is used as the microphone that it took me a while to realize that I was directing my voice into the wrong place. Talk into the lower-right corner of the speaker where there is a little rectangular slot cut into the case, and you will get full audio quality!

The unit comes in a grey plastic case, lacks the bells and whistles that inhabit the fronts of other brands of HTs, and doesn't have as much shiny metal. To me, it looks more like a policeman's HT than a ham's playtoy.

Along with the radio you get the rubberized flexible antenna, a BP-3 battery pack and a wall charger for it, a metal belt clip and two screws with which to attach it to the radio, a hand strap (which I never use), an earphone (which I never use), and one each submini plug and mini plug for the external mike and speaker jacks. You also get an instruction manual which gives a good general idea of what is going on, and two separate sheets which are quite detailed schematic and circuit board layouts. The size and appearance of the rig is identical to the IC-2A/AT, and except for antennas, they use the same accessories.

The radio will not scan unless you want to wear out your fingers on the thumbwheel switches, so you must own a programmable scanner or know the frequencies you will be using. Otherwise, you may need to get one

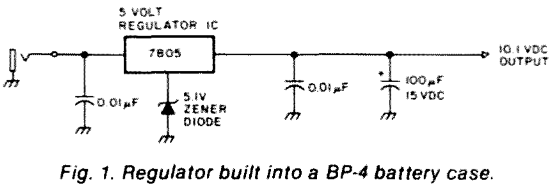


Fig. 1. Regulator built into a BP-4 battery case.

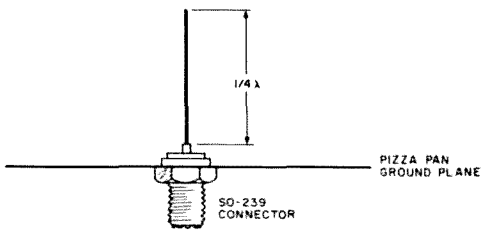


Fig. 2. An improvised quarter-wave ground-plane antenna.

of the band-scanning rigs instead of this one.

For some serious rag-chewing with this rig, you need either a basketful of batteries or an ac-operated power supply. I have built a regulator circuit into a BP-4 battery pack case which allows me to use the car battery (via a cigarette lighter power adapter and a miniature plug) or my unregulated 13.8-V-dc power supply at home. The schematic for the regulator is shown in Fig. 1, and Photo B is a close-up of the finished product. (If you don't like my way, you can look up WB3JJF's article in the February, 1981, issue of *Ham Radio*.)

When I'm at home, I use an improvised quarter-wave groundplane antenna that works quite a bit better than the rubberized whip antenna. It consists of a pizza pan (for the ground plane) with a hole in the center to hold an SO-239 jack. (See Fig. 2.) I soldered a stiff copper wire to the top of the jack. A PL-259 plug with RG-58/U or RG-8/U cable is screwed onto the connector, and the length of the copper wire whip is trimmed to one-quarter wavelength or for lowest standing-wave ratio at your favorite frequency.

Unfortunately, I don't have a lot of sophisticated test gear, but I can tell you that .3 microvolts of signal will definitely quiet all the rushing noise in my receiver. The power with a fresh battery is somewhat higher than that stated in the manual, and most amazing of all (to me) is that all channels are stable, with very little frequency drift.

I got my IC-4A for just under $260 from my local ham radio store in December, 1981, and for another twenty dollars or so, I could have gotten the touchtone™ pad version.

I want to thank WA8JJI for the improved antenna idea, my sister Frances for the permanent loan of two of her pizza pans, and also Mike Landis, who took the pictures.

Now I can hardly wait for Icom to come out with its 23-cm (1215-1300-MHz) band HT. For more information, contact *Icom America, 2112 116th Ave. NE, Bellevue WA 98004.*

Walter R. Stringer N8BSG
Ferndale MI

IC-25A 2M FM MOBILE RIG

It may be a mystery to most of us how the manufacturer managed to stuff so many components, operating features, and good ideas into so small a package, but it is no mystery that the trend in ham gear today is toward the small. In this ham's opinion, with reference to medium power (25-W) VHF ham gear, the apogee of miniature electronics is reached by the Icom IC-25A two-meter FM mobile rig.

Features

The rig measures a mere 5" by 2" by 7" and weighs in at a paltry 3.3 pounds. Within these lilliputian dimensions, Icom has crammed 48 transistors, 5 FETs, 19 ICs, 91 diodes, and a 4-bit microprocessor to keep track of the lot. The result of this shoehorning is a feature-packed mobile radio that offers the user: 25-W/1-W power outputs, scanning of five memory and two vfo frequencies, full or programmed band scan, programmable splits for non-standard repeaters, dual-speed vfo tuning in 5-kHz or 15-kHz steps, seven-segment S/rf LED bar display, priority channel function, normal/reverse function for monitoring repeater inputs or working inverse splits, and, most important, two fully-independent vfo's. And all this from the front panel!

Should you require more options, you need only open the top cover to gain access to: a scan speed control, a scan-stop timing control, a scan-stop timer switch, and a scan-stop function switch. The last allows the operator to choose either busy or open channels for scan-stop.

By comparison, the rear panel is simple. Here, arrayed around a massive heat sink of the SC1019 power amplifier, is a power-connection cable, an SO-239 antenna connector, and an external speaker jack (4 to 8 Ohms).

The IC-25A is designed to run off a 13.8-V-dc source, and no provisions are made for reversing the negative ground configuration of the supply. The manufacturer claims that the unit draws 400 mA in squelched receive and 600 mA with full audio output of 2 Watts. In the transmit mode, the rig draws 1.3 A at one Watt out and a healthy 4.8 A for the full 25-W output. Icom suggests that a 6-A supply be used in base-station applications.

Design

Electrically, the IC-25A exemplifies solid design practice. The transmitter uses a double-balanced mixer and variance-reactance frequency modulation to generate 16F3 output. A high-impedance dynamic mike with built-in touchtone™ pad and preamplifier is provided as standard equipment. The receiver employs a double-conversion superhet scheme (i-fs at 16.9 MHz and 455 kHz) as well as a MOSFET rf amplifier. A double-balanced mixer, two monolithic crystal filters, and several ceramic filters are provided to improve selectivity.

The most unusual aspect of the IC-25A's design is the dual vfo system. The rig's heredity can be seen clearly from its frequency-control system, and anyone who has ever operated an Icom 701, 720, 730, etc., will feel quite at home with the IC-25A. At the heart of the frequency-control system is a digital phase-locked loop (PLL) circuit that generates 40-MHz and 122-MHz signals.

A rotary encoder connected directly to the main tuning dial generates clock pulses for up/down frequency selection. A 4-bit-wide CPU chip running under the control of Icom firmware provides the smarts. The result in an extremely flexible frequency-control system that allows for continuous tuning in 5-kHz or 15-kHz steps, depending on which of the two vfo's is chosen.

About the only feature left out of the IC-25A's frequency selection system is the ability to memorize offsets. As a result, operator intervention is required if operation is desired on a memory frequency with a new split.

Performance

The bottom line for any piece of mobile gear is its performance on the open road. After commuting with the IC-25A for more than three months, I can say honestly that it is one of the friendliest mobile rigs I have ever used. Of paramount importance in a rig this size is front-panel layout. With 13 controls jammed into an 11-square-inch area, the ergonomics of the layout had better be good.

Vfo and memory-selection channel switches are located toward the driver, on the left side of the front panel. The large main tuning knob also is skewed to the left. Volume/on-off and squelch/high-low power controls are placed adjacent to one another and, immediately above them, three push switches provide easy (yet isolated) access to scan-width control, simplex/duplex control, and Nor/Rev function.

The one inconvenient placement on the front panel is the proximity of the memory-write switch and the scan-stop switch. A problem often occurs when, in an effort to initiate scanning, an operator inadvertently depresses the memory-write switch. When this happens, an erroneous frequency (whatever happens to be in the vfo at the time) will be written into one of the memory channels. The problem is further compounded by the identical feel of the switches. (Mike-scan control is an option, however.)

Another front-panel shortcoming involves the display. Aside from the normal visibility problems inherent with red displays operating in bright sunlight, the IC-25A display is difficult to read because it uses an LED instead of a full 7-segment digit in the 5-kHz position. As a result, it can be difficult to discern whether the frequency is 7.37 or 7.375. There seems to be room on the front panel for a full-size 4-digit display, and the rig certainly would benefit from the addition of a real digit in the 5-kHz position.

Used in conjunction with a 1/4-wave whip, the IC-25A was able to access any repeater it heard. In fact, it often heard too much. My unit displayed adjacent-channel interference on strong signals (40-60 dB) 15 kHz away from the center of the passband, resulting in cross-modulation of the incoming audio. The problem seemed more acute on the high side of the passband, indicating a slight receiver alignment irregularity. In any case, the problem, though annoying, was apparent only on the strongest of signals.

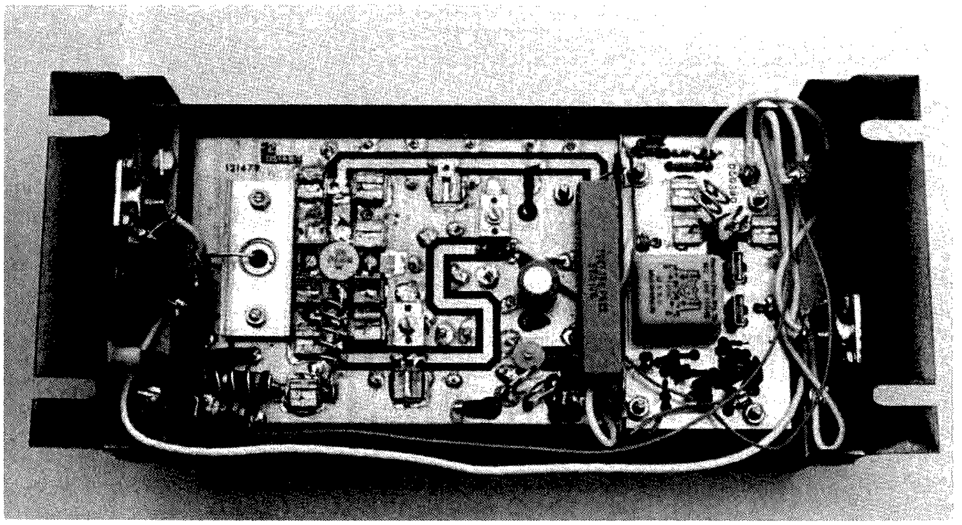
With any radio of this complexity and compactness, documentation is crucial. Icom has done a laudable job in this area, and its efforts are by no means limited to the 34-page owner's manual. An 11" by 16" schematic is included as well as life-size component overlays for each PC board. When used in conjunction with the comprehensive theory-of-operation section of the manual, graphics like these could get hams once more into

troubleshooting and even repairing their own gear.

The IC-25A is an impressive package of performance and features at a very competitive price. (The list price is $349.) Its small size will make it attractive to owners of today's gas-efficient micro-cars, and as an added benefit, when installed in-dash like a normal car radio, the rig is relatively immune to theft. If you want big radio functions in a small package, Icom's new IC-25A is worth your consideration.

For more information, contact *Icom America, 2112 116th Ave. NE, Bellevue WA 98004.*

Chris Brown KA1D
Groton MA



Heath VL-1180 All-Mode VHF Amplifier. The amplifier board is on the left, T-R board on the right.

HEATHKIT MODEL VL-1180 ALL-MODE VHF AMPLIFIER

New England is a land of hills and valleys; it's challenging country for 2-meter mobile operation. I discovered just how challenging shortly after installing a 10-Watt rig in my car. Delighted at being able to hear my buddies chatting on a popular repeater some 20 miles distant, I attempted to join the conversation. "Sorry old man, you're not quite making the machine." How humiliating!

An amplifier was definitely in order. And since my 2-meter rig is an all-mode radio, I wanted an amp suitable for SSB and CW, as well as FM. The Heathkit VL-1180 All-Mode VHF Amplifier had just been announced. As a long-time Heathkit builder, I couldn't resist.

Description

The VL-1180 is a linear amplifier covering the 144-148-MHz range. It is designed for use with exciters providing between 1 and 10 Watts of drive. A Motorola MRF-247 transistor is used as the final, and the nominal output is 75 Watts with 10 Watts input. Insertion loss is 0.6 dB. The amplifier features a self-contained transmit-receive (T-R) relay which is keyed either by a push-to-talk line from the exciter or by the rf sensing circuit built into the VL-1180. The amplifier operates on 11.5-15 V dc and draws 11 Amps at 75 Watts output. Standby current is a mere 3 mA.

The VL-1180 measures 2-1/2 × 4-5/8 × 10-1/2 inches and weighs 3-1/2 pounds. A power switch is the only control provided. The power leads and T-R switching line (if used) enter the amplifier by way of a three-conductor Molex® plug.

Except for connectors and the power switch, all components in the VL-1180 mount on a pair of double-sided printed circuit boards. The larger of the two holds the amplifier circuitry. A smaller board contains T-R switching. Assembling the amplifier took five easy evenings. While no insurmountable problems were encountered, the amplifier board was a challenge in one respect.

In order to ensure a good connection between the ground foils on the top and bottom of the board, you are instructed to install and solder in place 47 tiny rivets. While tedious, this is a simple procedure. The rub comes when, in six places, you are required to solder a metal-cased mica capacitor to the circuit board, squarely on top of a rivet head. Due to the presence of the rivet, it is difficult to get the "continuous bonding" between capacitor and PC foil called for in the manual. A simple relocation of the six offending rivet holes would cure a minor but aggravating problem. As with all Heathkits, the best course is to follow the instructions as closely as possible.

With the VL-1180 temporarily installed in my car, alignment was a breeze, requiring about 15 minutes from start to finish. Tune-up is accomplished with a minimum of equipment: a 2-meter exciter, an swr meter, and a dummy load. Heath deserves a round of applause for designing an amplifier that is so easy to align; they even supply the necessary alignment tools. When aligned at 146 MHz, the output with 10-W drive was at least 80 W across the entire 2-meter band. One Watt of drive produced 9 Watts out. Input swr was less than 1.5:1 throughout the band.

The additional power provided by the VL-1180 has made all the difference in my FM mobile operations. No more humiliation when attempting to join the fun on the repeater! The amplifier has proven itself on SSB as well. I have spent many a Sunday afternoon atop our local drive-up mountain talking to the SSB boys on 144.2 MHz, using a portable five-element beam.

After more than six months of heavy use, the VL-1180 continues to perform well. Output power is unchanged from the original 80 Watts. The low standby current drain means that the amplifier can be left turned on at all times, unless the car isn't going to be driven for weeks on end.

Summary

Heath has done a nice job in creating an all-mode 2-meter linear kit that goes together without much difficulty and doesn't require a sophisticated test bench to align. A solution to the rivet problem should be considered, however, even if it's only to acknowledge it in the manual. Ideally, Heath should switch to a circuit board with plated-through holes.

The bottom line is, that despite minor construction difficulties, my VL-1180 worked the first time out and has worked ever since. It's hard to ask more from any piece of equipment. The VL-1180 is priced at $137.95 from *Heath Company, Benton Harbor MI 49022.* Reader Service number 475.

Jeff DeTray WB8BTH
***73 Magazine* Staff**

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SATELLITES

PHASE IIIB LAUNCH DELAYED

We'll all have a bit more time to prepare for Phase III satellite activity. The European Space Agency (ESA) has announced a delay of at least two months in the flight that is scheduled to carry AMSAT's Phase IIIB satellite. At best, the launch will now occur in late September; it was originally set for July.

The problem is not with the Phase IIIB satellite or the Ariane launch vehicle, but with the design of the satellite that is to be the main payload on several Ariane launches. A similar satellite, MARECS-A, was launched in December and has developed some unexpected problems. Until the causes and cures for the problems can be determined, the scheduling of the Phase IIIB launch will remain uncertain.

TEN-TEC RIG

At the Dayton Hamvention in late April, Ten-Tec displayed a prototype of a rig designed to ease the average amateur into Phase III satellite communications, using the Mode B (435-144 MHz) transponder. The new unit contains a 10-W, 435-MHz CW/SSB transmitter and a 2-to-10-meter receive converter. Assuming you already have 10-meter receiving capability, you need only add antennas for 435 and 144 MHz to complete your Phase III satellite station. Ten-Tec doesn't plan to release the rig until Phase IIIB is safely aloft, i.e., sometime this fall.

ORBITAL CALENDARS

Project OSCAR, a California-based group of amateur satellite enthusiasts, has produced a comprehensive calendar of orbital predictions covering OSCAR 8 and all six Soviet RS satellites. This volume gives the time and longitude of the northbound equatorial crossing for each orbit of each satellite from May 1 through December 31, 1982. It's a must for satellite chasers. The calendar is available for an $8.75 donation. Your check or money order payable to Project OSCAR, Inc., should be mailed to POB 1136, Los Altos CA 94022. The price includes postage.

Thanks to *AMSAT Satellite Report* for some of the preceding information.—WB8BTH.

ORBITAL INFORMATION

OSCAR 8 Reference Orbits - July

Date	Time (UTC)	Eq. Crossing (Degrees West)
1	0132:12	95.3
2	0136:35	96.5
3	0140:59	97.6
4	0002:12	73.0
5	0006:36	74.2
6	0011:00	75.3
7	0015:23	76.5
8	0019:47	77.6
9	0024:11	78.8
10	0028:34	79.9
11	0032:58	81.1
12	0037:22	82.3
13	0041:45	83.4
14	0046:09	84.6
15	0050:33	85.7
16	0054:56	86.9
17	0059:20	88.0
18	0103:44	89.2
19	0108:07	90.4
20	0112:31	91.5
21	0116:55	92.7
22	0121:18	93.8
23	0125:42	95.0
24	0130:05	96.2
25	0134:29	97.3
26	0138:53	98.5
27	0000:06	73.8
28	0004:30	75.0
29	0008:53	76.1
30	0013:17	77.3
31	0017:41	78.5

OSCAR 8 Reference Orbits - August

Date	Time (UTC)	Eq. Crossing (Degrees West)
1	0022:04	79.6
2	0026:28	80.8
3	0030:52	81.9
4	0035:15	83.1
5	0039:39	84.3
6	0044:03	85.4
7	0048:26	86.6
8	0052:50	87.7
9	0057:14	88.9
10	0101:37	90.0
11	0106:01	91.2
12	0110:25	92.4
13	0114:48	93.5
14	0119:12	94.7
15	0123:36	95.8
16	0127:59	97.0
17	0132:23	98.1
18	0136:46	99.3
19	0141:10	100.5
20	0002:24	75.8
21	0006:47	77.0
22	0011:11	78.1
23	0015:34	79.3
24	0019:58	80.5
25	0024:22	81.6
26	0028:45	82.8
27	0033:09	83.9
28	0037:33	85.1
29	0041:56	86.2
30	0046:20	87.4
31	0050:44	88.6

See List of Advertisers on page 114

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SOCIAL EVENTS

from page 78

City Park Avenue, New Orleans LA 70119. (504)-483-4115.

FLAGSTAFF AZ
JUL 30-AUG 1

The Amateur Radio Council of Arizona will hold its 32nd annual hamfest from July 30 through August 1, 1982, at the Fort Tuthill Fairgrounds, just a few miles south of I-40, Flagstaff AZ. There will be thousands of dollars in prizes, improved XYL activities, a swapfest, a transmitter hunt, speakers, forums, awards, exhibits, and entertainment on Friday and Saturday nights. Overnight camping facilities will be available. Talk-in on 147.870/146.270. For further information, contact Wm. Oliver Grieve W7WGW, 4301 N. 31st Avenue, Phoenix AZ 85017, or call (602)-246-0200.

KINGSFORD MI
JUL 31-AUG 1

The Mich-A-Con ARC will hold the 34th annual UP Hamfest on Saturday, July 31, and Sunday, August 1, 1982, at the Dickinson County Armory on M-95, Kingsford MI. Tickets are $2.50 at the door (no advance sales) and registration will begin at 9:00 am on both days. There will be prizes, family activities, and a Saturday night banquet. Advance banquet reservations are needed since seating is limited. Plenty of free parking will be available. Talk-in on 146.25/.85 and .3922. For further information, write UPHAMFEST-82, 105 East Breitung Avenue, Kingsford MI 49801.

ANGOLA IN
AUG 1

The Steuben County Radio Amateurs will hold the 24th annual FM Picnic and Hamfest on Sunday, August 1, 1982, at Crooked Lake, Angola IN. Admission is $2.50. There will be prizes, picnic-style BBQ chicken, inside tables for exhibitors and vendors, and overnight camping. (A fee will be charged by county park.) Talk-in on 146.52 and 147.81/.21.

PITTSBURGH PA
AUG 1

The 45th annual South Hills Brass Pounders and Modulators Hamfest will be held on August 1, 1982, from 10:00 am to 4:00 pm, at South Campus, Community College of Allegheny County, Pittsburgh PA. Admission is $2.00 or 3 for $5.00. There will be computer, OSCAR, and ATV demonstrations, as well as a flea market. Talk-in on 146.13/.73 and 146.52. For further information, contact Andrew L. Pato WA3PBD, 1433 Schauffler Drive, West Homestead PA 15120.

BELVIDERE IL
AUG 1

The Big Thunder ARC will hold its annual hamfest on Sunday, August 1, 1982, at the Boone County Fairgrounds, Route 76, Belvidere IL. Admission is $2.00 in advance and $2.50 at the gate. A fee will be charged for 8-foot tables and there will be indoor space available in the exhibit building, as well as outdoor space in swappers' row. Sellers will be able to set up Saturday evening or at 7:00 am on Sunday. Features will include door prizes, a main prize, food, and refreshments. Camping will be available on Saturday evening (there will be a charge for electricity). Talk-in on 146.52 and 147.975/147.375. For further information or tickets, send an SASE to Jim Grimsby, 418 Beacon Drive, Belvidere IL 61008.

LEVELLAND TX
AUG 1

The Hockley County Amateur Radio Club and the Northwest Texas Emergency Net will hold their 17th annual picnic and swapfest on Sunday, August 1, 1982, beginning at 6:00 am at the city park in Levelland TX. This event is for the entire family. Bring your own picnic basket for lunch at 12:30. A two-meter FM transceiver is the grand prize. A $3.00 registration is requested but not required. There will be swapping all day, with tables provided. Talk-in on .28/.88.

GLEN MI
AUG 1

The Black River Amateur Radio Club will hold the 29th annual Southwestern Michigan VHF Picnic on Sunday, August 1, 1982, at the West Side County Park near Glen MI. (Take exit 30 from I-196 and follow the signs.) There will be swimming, a playground, a small flea market, and door prizes. There is no food available at the park, so bring your own picnic basket. Registration is $1.00. For additional information, contact Ed Alderman KI8Z, RR #2, Box 44, Lawrence MI 49064.

POMONA CA
AUG 7

The Tri-County Amateur Radio Association will hold its annual hamfest/picnic on Saturday, August 7, 1982, from 7:00 am to 1:00 pm, at the Los Angeles County Fairgrounds, Pomona CA. All buyers, sellers, and computer buffs are welcome. There will be prizes, exhibits, and refreshments. Talk-in on 146.025/.625. For more information, write to TCARA Hamfest Chairman W6ELZ, PO Box 142, Pomona CA 91769.

JACKSONVILLE FL
AUG 7-8

The Greater Jacksonville Hamfest Association will hold the annual Jacksonville Hamfest and Northern Florida ARRL Convention on August 7-8, 1982, at the Orange Park Kennel Club, located near the intersection of I-295 and US 17 just south of Jacksonville. Advance registration is $3.50 and is available from Robert J. Cutting W2KGI, 1249 Cape Charles Avenue, Atlantic Beach FL 32233. Registration at the door is $4.00. The FCC will administer amateur and commercial radio operator exams on Friday, August 6th, at the hamfest site. Those wishing to take the exams should apply to the Atlanta FCC office as soon as possible. Swap tables are $12.00 per table for both days (no one-day tables) and table reservations, as well as advance registrations, are available from Andy Burton NX4G, 5101 Younis Road, Jacksonville FL 32218. A full slate of programs is scheduled, along with meetings of statewide and regional nets and organizations, plus competitions including a rabbit hunt and pileup contest. The headquarters hotel is the Best Western First National Inn just across from the hamfest. Special rates may be obtained by writing to Jim Canfield KD4CG, 996 Dostie Circle, Orange Park FL 32073. Talk-in on 146.16/.76 and 146.07/.67.

SAUK RAPIDS MN
AUG 8

The St. Cloud Radio Club will hold its annual hamfest on Sunday, August 8, 1982, from 8:30 am to 4:00 pm, at the Sauk Rapids Municipal Park, Sauk Rapids MN. Talk-in on 146.34/.94. For more information, contact Mike Lynch, 2115-1st Street, St. Cloud MN 56301, or call (612)-251-2297.

MONTGOMERYVILLE PA
AUG 8

The Mid-Atlantic Amateur Radio Club announces its annual J. B. M. Hamfest to be held on Sunday, August 8, 1982, from 9:00 am to 4:00 pm, rain or shine. Tailgate setup begins at 8:00 am. Located at the Route 309 Drive-In Theater, 1/4 mile north of Route 63, Montgomeryville, PA (6 miles north of the Fort Washington interchange of the Pennsylvania Turnpike). Admission: $2.50, with $1.00 additional for each tailgate space. Non-licensed XYLs and children admitted free. Ample parking, refreshments, raffles, door prizes, and more. Talk-in on WB3JOE/R (147.66/.06) or 146.52 simplex. For further information, write the club, PO Box 352, Villanova PA 19085.

TACOMA WA
AUG 14-15

The Radio Club of Tacoma will hold Hamfair 82 on August 14-15, 1982, at the Pacific Lutheran University campus, Tacoma WA. Registration is $5.00 and dinner is $7.50. Activities will include technical seminars, a flea market, commercial booths, an ARRL meeting, a repeater forum, a VHF tweak and tune clinic, prizes, raffles, and a loggers' breakfast. Talk-in on 147.88/.28. For more information, contact Grace Teitzel AD7S, 701 So. 120th, Tacoma WA 98444, or phone (206)-564-8347.

WILMINGTON DE
AUG 15

The seventh annual New Delmarva Hamfest will be held on Sunday, August 15, 1982, from 8:00 am to 4:00 pm at Gloryland Park, Bear DE (5 miles south of Wilmington). Admission is $2.25 in advance, $2.75 at the gate. Tailgating is $3.50. Limited tables will be available under the pavilion, but bring your own to be sure. Food and drinks will be available. First prize is an Atari® Home Video Game System. Talk-in on .52 and .13/.53. For more information and a map, send an SASE to Stephen Momot K3HBP, 14 Balsam Road, Wilmington DE 19804. For advance tickets, make checks payable to Delmarva Hamfest, Inc.

TIOGA COUNTY PA
AUG 21

The Tioga County PA ARC 6th Annual Amateur Radio Hamfest will be held on Saturday, August 21, 1982, from 0800 to 1600 at a new location at Island Park, just off US Rte. 15, Blossburg PA. There will be a flea market, food, free camping, an auction, an H/T door prize, etc. Talk-in on .19/.79 and .52. For more information or advance tickets, write Tioga Co. ARC, PO Box 56, Mansfield PA 16933, or contact Paul Sando KC2AZ, 606 Reynolds Street, Elmira NY 14904 on .19/.79 or .96/.36.

MARYSVILLE OH
AUG 21-22

The Union County Amateur Radio Club will hold the Marysville Hamfest on Saturday afternoon and all day Sunday, August 21-22, 1982, at the fairground in Marysville (near Columbus) OH. Admission is $2.00 in advance or $3.00 at the gate. Flea market space is $1.00. Food, beverages, and free overnight camping, movies, and popcorn will be available. Featured on Saturday night will be a free square dance (with a live band) followed by a big country breakfast available all night. Door prizes, ladies' programs, and ARRL, FCC, and MARS meetings will be featured on Sunday. Talk-in on 146.52 and 147.99/.39. For additional information, write UCARC, 13613 US 36, Marysville OH 43040, or call (513)-644-0468.

ST. CHARLES IL
AUG 22

The Fox River Radio League will host the Illinois State ARRL Convention in conjunction with its annual hamfest, both to be held on August 22, 1982, from 8:00 am to 4:00 pm, at the Kane County Fairgrounds, St. Charles IL. Tickets are $2.00 in advance and $3.00 at the gate. For advance tickets, send an SASE to J. Dubeck KA9HQY, 1312 Bluebell Lane, Batavia IL 60510. There will be commercial exhibits, a flea market, contests, demonstrations, forums, prizes, and hot food. Talk-in on 146.94. Exhibitors, dealers, and vendors should contact G. R. Isely WD9GIG, 736 Fellows Street, St. Charles IL 60174.

WENTZVILLE MO
AUG 22

The St. Charles Amateur Radio Club, Inc., will hold Hamfest 82 on August 22, 1982, at the Wentzville Community Center, Wentzville MO. Tickets in advance are $1.00 each or 4 for $3.00; at the door, they are $1.50 each or 4 for $5.00. Admission is $1.00 per car. There will be prizes, contests, a flea market, food, and air conditioned exhibitions buildings. For tickets, motel and camping information, prize lists, dealer reservations, etc., write SCARC Hamfest 82, c/o Mike McCrann WD0GSY, 25 Elm Street, St. Peters MO 63376.

SEWELL NJ
AUG 29

The Gloucester County Amateur Radio Club will hold its fourth annual GCARC Ham/Compfest on Sunday August 29, 1982, from 8:00 am to 3:00 pm at the Gloucester County College, Tanyard Road, Sewell NJ. Tickets are $2.00 in advance and $2.50 at the door. The tailgaters' and dealers' charge is $6.00 and includes one free admission. Doors will open at 7:00 am for setup. There will be speakers, seminars, contests, FCC exams, and prizes, including a Radio Shack TRS-80 computer and a Yaesu FT-208R. Talk-in on 146.52 and 147.78/.18. For more information, contact GCARC Hamfest Committee, PO Box 370, Pitman NJ 08017, or phone (609)-456-0500 or (609)-338-4841 (days) or (609)-629-2064 (evenings).

BUTLER PA
SEP 12

The Butler County Amateur Radio Association will hold its annual hamfest on Sunday, September 12, 1982, from 9:00 am to 4:00 pm, at the Butler Farmshow Grounds at Roe Airport, Butler PA. Fly-in at Butler Farmshow Airport. Admission is a $1.00 donation and children under 12 will be admitted free. Overnight campers are welcome and food and refreshments will be available. There will be an indoor flea market (vendor space will be $3.00 per 8-foot table), a free outside flea market, free parking (including for the handicapped), and prizes, including a Kenwood TS-830S HF transceiver. Talk-in on 147.96/.36, .52, and 147.84/.24. For additional information, contact Leighton Fennell, Crestmont Drive, RD 6, Butler PA 16001, or phone (412)-586-9822.

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ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	14	7	14	21	21	21A	21	21
AUSTRALIA	21	14	14	14	7	7	7	7	7	7	14A	21
CANAL ZONE	21A	21	14	14	7A	7	14	14	14	21	21	21
ENGLAND	14	14	7A	7	7	7A	14	14	21	21	14A	14
HAWAII	21	14	14	14	7	7	7	14	14	14	21	21
INDIA	14	14	14	7B	7B	7B	14	14	14	14	14	14
JAPAN	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
MEXICO	14A	14	14	7A	7	7	7A	14	14	14A	21	21
PHILIPPINES	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14A	14A	14	7A	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	14	7B	7B	14	14	14	14A	21	21A	21A	21	14
U. S. S. R.	14	14	7	7	7	14	14	14	14	14	14A	14
WEST COAST	21	14A	14	14	7	7	7	14	14A	14A	21	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	14	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	14	7	14	14	21	21A	21	21
AUSTRALIA	21	14	14	14	7A	7	7	7	7	7	14A	21
CANAL ZONE	21A	21	14	14	7A	7	14	14	14	21	21	21
ENGLAND	14	14	7	7	7	7	14	14	14A	14A	14	14
HAWAII	21	14A	14	14	14	7	7	14	14	21	21	21
INDIA	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
JAPAN	14	14	14	14	7B	7B	7B	14B	14	14	14	14
MEXICO	14	14	7A	7	7	7	7	7A	14	14	14A	14A
PHILIPPINES	14	14	14	14B	7B	7B	7B	7B	14	14	14	14
PUERTO RICO	21	21	14	14	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	14	7B	7B	7B	7B	14B	14	14	14	14A	14A	14
U. S. S. R.	14	14	7	7	7	7B	14B	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	14	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	14	7	14	14	21	21A	21	21
AUSTRALIA	21A	21	21	14	14	14	14	14	7	7	14A	21
CANAL ZONE	21A	21	14	14	7A	7	7	14	14	14A	21	21
ENGLAND	14	14	7	7	7	7	7	14	14	14	14	14
HAWAII	21A	21	21	14	14	14	14	14	14	21	21	21A
INDIA	14	14	14	14	14B	7B	7B	7B	14	14	14	14
JAPAN	14A	14	14	14	14	14B	7B	14	14	14	14	14
MEXICO	14A	14	14	14	7A	7	7	14	14	14A	21	14A
PHILIPPINES	14A	14	14	14	14	14B	7B	7B	14	14	14	14
PUERTO RICO	21	21	14	14	7	7	7A	14	21	21	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	7B	14	14	14	14A	14
U. S. S. R.	14	14	7	7	7	7B	7B	14B	14	14	14	14
EAST COAST	21	14A	14	14	7	7	7	14	14A	14A	21	21

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

JULY

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G/G	2 G/G	3 F/F
4 F/G	5 G/G	6 G/G	7 F/F	8 F/G	9 F/G	10 F/G
11 F/F	12 F/G	13 G/G	14 G/G	15 F/F*	16 P/F*	17 F/G*
18 F/G*	19 P/F*	20 F/G	21 G/G	22 G/G	23 G/G	24 F/G
25 F/G	26 G/G	27 G/G	28 G/G	29 G/G	30 G/G	31 G/G

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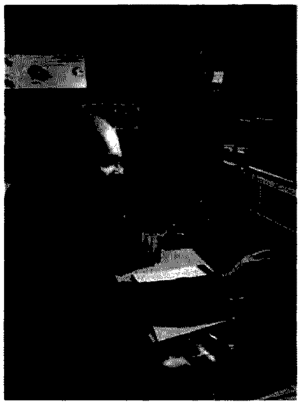
Spectrum Analyzer—10



W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

THE WORLD'S FAIR—KNOXVILLE

Yes, there is a ham exhibit at the new World's Fair. The local hams got together and managed to get some space in the Knoxville exhibit for the station. It's a good looking exhibit, packed with Ten-Tec gear for the most part. That's not too surprising since Ten-Tec's plant is just a few miles from Knoxville.

The fair isn't large by World's Fair standards. I've only seen a few such fairs, so perhaps I was expecting too much. I am old enough to have spent a good deal of time wandering the New York fair in 1938, watching the early television programs being produced. They had iconoscope cameras in those days, so the lights had to be fierce compared with the later developed image orthocons, which were far more sensitive (and expensive).

They had a lot of entertainment exhibits at that fair. I didn't see much of that at Knoxville. Here the exhibits are almost entirely international and national, with little from our major industrial corporations.

At the Montreal fair, there was a good deal of entertainment, but the lines were so long to watch it that many were discouraged. I know I had to miss most of the highly touted shows because I didn't have a day apiece to devote to line standing. Fortunately, most of the ones that I had to miss at Montreal turned up when San Antonio had their World's Fair, so I eventually saw them.

I'm beginning to recognize that a successful fair means hot weather and long, long lines. I think the line for the Chinese exhibit is almost the length of the whole fair! It reminded me of an illustration by Ripley for an item which said that there were so many Chinese that a column of them four wide could parade by night and day forever, with the newly born keeping up with the pace of the line. The line at the fair seemed endless. Most of the more interesting exhibits had lines, but none compared with the Chinese.

It appears that Knoxville has gotten a bum rap from some of the media. I was there in late May and found little problem in getting hotel accommodations. Even when I went on Sunday to the fair, I was able to park within one block of the fair gate. They have parking lots all around the outskirts of town where you can leave your car and be commuted by a bus.

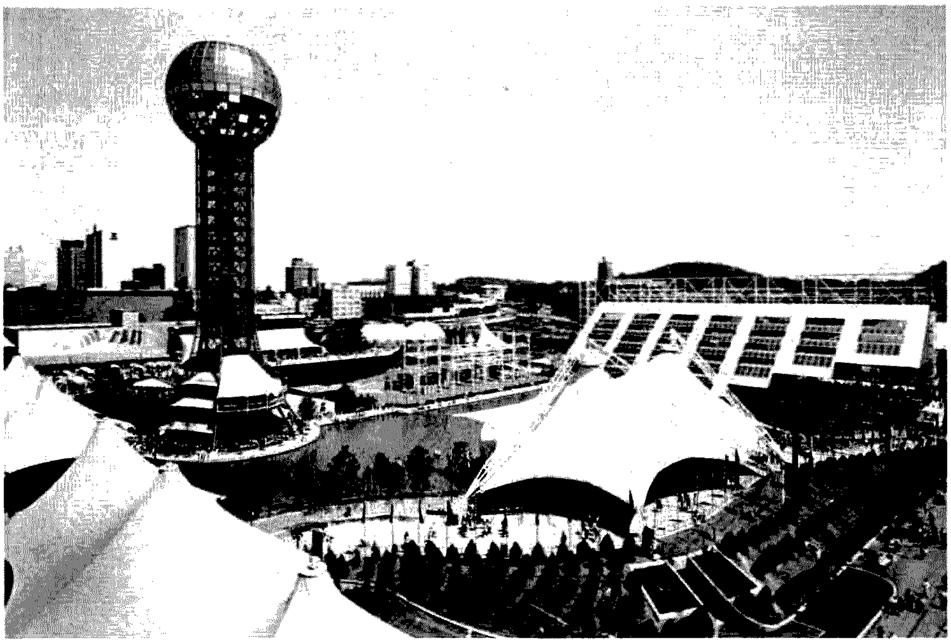
Of course, my favorite subject is food. That was one of my big memories of the New York fair of '38. Montreal was a bust, with most of the food stands selling only buffalo burgers—which are okay, but not exciting.

At San Antonio, I had a great time eating. They had all sorts of fast food services. Knoxville has done the same. They have one of the widest varieties of food of any fair yet. Have you ever seen a cobbler stand? Yep, a choice of apple, cherry, blueberry, or mixed fruit cobbler, with or without soft ice cream. You could also get Belgian waffles, nice and fresh and crisp, with either whipped cream or soft ice cream.

There are plenty of repeaters around Knoxville, so if you decide to drive to the fair you won't have any problem getting talked in. I called in on 146.73 and got route instructions—first to the Knoxville hamfest, then to the fair. No problem getting help.

If you're within driving distance of Knoxville, I'd say it's worth your while to plan on getting down there (or up) this summer. Be sure to check in at the ham exhibit and log in. If you flash your ham license, they'll let you sit down and do some contest-type operating. It seems that World's Fair stations are reasonably rare, so there are pileups for everyone. It's a lot easier than getting down to Swaziland or something. And you can get a taste of quite a bunch of foreign countries by visiting their exhibits.

Speaking of the Knoxville hamfest, while I didn't see anyone there from *Ham Radio* magazine, I did catch a glimpse



Three of the landmark structures of The 1982 World's Fair in Knoxville, Tennessee, form around the three-acre Waters of the World Lake. At left is the Sunsphere, 266 feet high and the "theme structure" of the exposition. The five-level sphere, encased in glass made of 24-karat gold dust, houses a restaurant and two cocktail lounges and observation areas. In the right foreground is the 1,500-seat Tennessee State Amphitheatre. The United States pavilion (at far right) features "talk-back computers," a "national energy debate" utilizing television screens and a new IMAX film, to be shown on a screen seven stories high and 90 feet wide. Downtown Knoxville forms the background at left. (Photo by Mike DuBose)

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of one of the *CQ* chaps. Funny thing, even though this was an official ARRL hamfest, I didn't see any of their officials. Hmmm. Maybe I missed 'em.

The people at Ten-Tec, In addition to supporting the ham exhibit at the World's Fair, also had the most elaborate exhibit at the hamfest. I don't know how they get any work done!

The ham station at the fair was not of enough importance for the FCC to manage a special events call, but the Knoxville chaps were very resourceful. A local club had the call WA4KFS, so they "borrowed" the call for the fair...it representing the Knoxville Fair Station.

I sat down for a few minutes to see how the station was working. Aiming the beam at Europe, I found a relatively clear spot (not bad for Sunday afternoon on 20m) and called CQ. Wouldn't you know that the chap who came back to my call lives a few miles from Peterborough and, when he found out who was operating, mentioned that he drives past my place every day going to work!

Having been on the ham tour to China a year ago, I wasn't ready to face the three-hour or more line to see their exhibit. Then I found out that our press passes not only got us in the fair free, but were also useful for going to the head of lines. Hmmm. It makes good sense since one of the things the fair needs most desperately is some good press. So Sherry and I ambled down to the China exhibit, flashed our press passes, and got right in.

Sherry was disappointed, I think. Sure enough, China had all their stuff there on exhibit... with a lot of the items for sale. But It was pretty much the same as we'd seen at the Canton Trade Fair. We did come close to buying one of their gorgeous rugs. Only the problems of shipping it home slowed us down In Canton...now we had no such excuse. The rugs are spectacular and quite reasonable in price. They're not as inexpensive as in China, of course, but they're still a bargain.

The exhibit was interesting, but would have been a bummer if we'd had to invest much line time. That's probably one of the drawbacks to being into travel.

The worst days as far as lines are concerned are Friday and Saturday. Thursday Is the lightest attendance day, with Sunday being second. That's Baptist country, remember, and Sunday is for church. The lines for food were small, if any. Sure, if you really *had* to have a hamburger and wanted it at 12:30, there was a line. But right next to that stand you could get something more interesting with no wait. The Hungarian ex-

Continued on page 139

Well...I Can Dream, Can't I? by Bandel Linn K4PP

"While we were digging you a deeper ground, we struck oil!"

Poor Man's Spectrum Analyzer

—another 73 breakthrough

Frank H. Perkins WB5IPM
Box 13642
Arlington TX 76013

Hams enjoy making all types of electrical measurements. In fact, it's one of our favorite pastimes and topics of conversation. Fortunately, good, low-cost oscilloscopes, DVMs, and other instruments are available to us for measuring voltage, current, power, swr, frequency, and so on.

There is one instrument, however, that has been beyond the reach of most of our budgets—the spectrum analyzer. Commercial versions of this useful rf instrument start at $2500, which is a little steep for most of us. It is possible for you to build a simple spectrum analyzer for about $150 that works with a low-cost oscilloscope. The analyzer can be used to check HF transmitting equipment, among other applications. Its use, theory of operation, and construction are discussed in this article.

Spectrum Analyzer Operation

A spectrum analyzer is a special receiver that allows you to view the frequency components of its input signal on an oscilloscope CRT. The spectrum analyzer repeatedly tunes across the frequency band you have chosen with its center-frequency and frequency-span controls. For example, if you set the center-frequency control for 20 MHz and adjust the frequency-span control for a tuning range from 10 MHz below to 10 MHz above the center frequency, the analyzer will repeatedly tune the 10-MHz-to-30-MHz band.

As the analyzer tunes from the low end to the high end of the band, it moves the CRT trace from left to right. The S-meter output from the analyzer moves the CRT trace upward from the bottom of the CRT screen according to signal strength. A spectrum analyzer display usually looks like a number of spikes. The farther to the right a signal (spike) appears on the CRT, the higher its frequency; the strength of the signal is indicated by its height. There usually appears to be some "grass" along the bottom of the CRT display. This is due to noise. You probably have seen spectrum analyzer displays in ham gear sales literature and some magazine articles.

To appreciate how useful a spectrum analyzer can be, let's first look at Photo B, an rf signal on a normal oscilloscope. To me it looks like a clean sine wave. What do you think?

Now let's look at Photo C, the same rf signal on our spectrum analyzer. The half-spike on the left is our zero-frequency reference. The next signal to the right, which is the tallest, is the fundamental component of our rf signal. The three signals to the right of the fundamental are the 2nd, 3rd, and 4th harmonics.

If the spectrum of our transceiver or linear amplifier output looked the same as this photo, we would not be complying with FCC Regulation 97.73, even though our fundamental signal was properly within an HF amateur band.

To understand what's wrong, compare the height of the 2nd harmonic signal to the fundamental. The second harmonic is about 2.6 CRT divisions shorter than the fundamental. With a 10-dB-per-division vertical calibration, the second harmonic is 26 dB below the fundamental.

FCC Regulation 97.73 re-

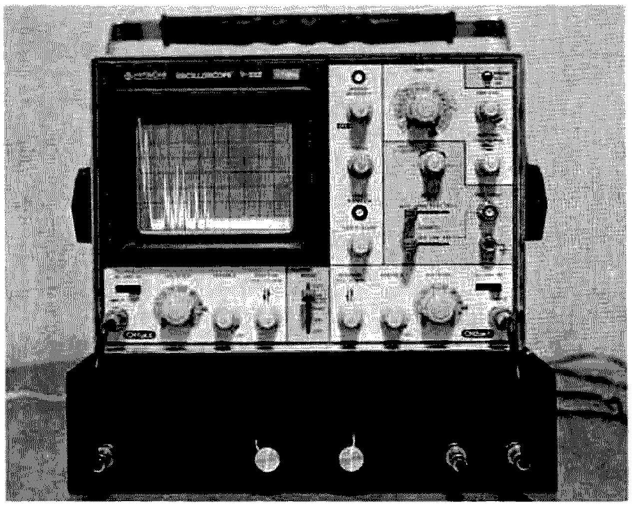


Photo A. High frequency spectrum analyzer covers 0 to 60 MHz.

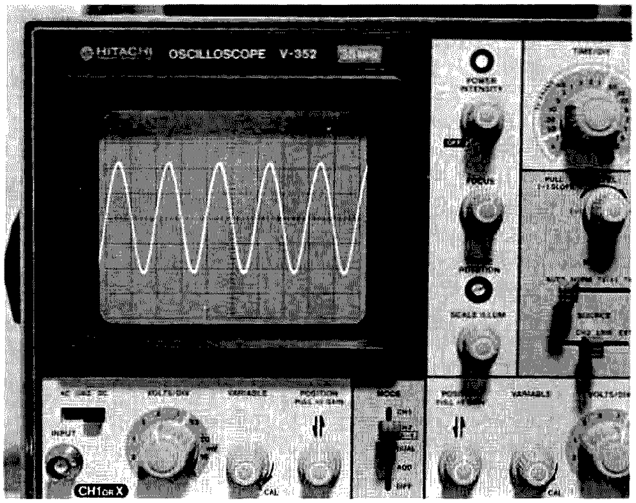


Photo B. Rf signal as viewed on an ordinary oscilloscope. Is this a clean signal?

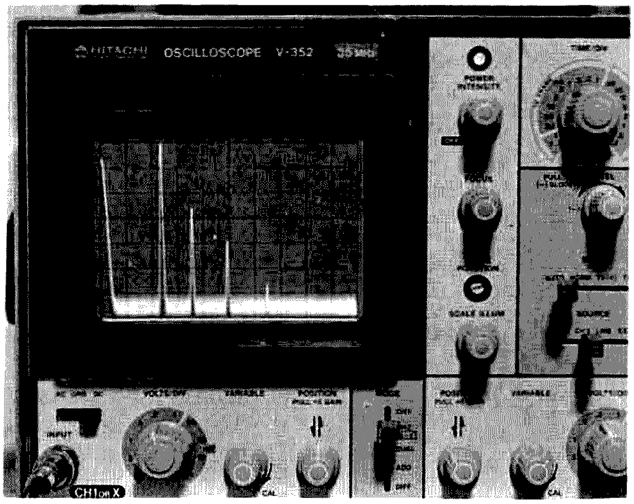


Photo C. Same rf signal on the spectrum analyzer. Second harmonic is only 26 dB below the fundamental. Don't put this signal on the air!

quires low-power transmitters up to 5 Watts to suppress all signal frequency components (spurs) outside the HF band of operation at least 30 dB below the fundamental. For a transmitter from 5 to 500 Watts, this figure is 40 dB. For a 1000-Watt transmitter or linear amplifier, the figure is 43 dB. Checking our photo again, we notice that the 3rd harmonic signal is about 39 dB below the fundamental. We're also going to have a problem with the 3rd harmonic if we are running 5 Watts or more power. The 4th harmonic is no problem since it's about 55 dB below the fundamental.

We can correct the problem by adding a filter between our transceiver or linear and the antenna. However, unless we are able to check the output spectrum of our transmitting equipment, we may never know we have a problem—until our neighbors start complaining or we get a "friendly advisory" from the local FCC monitoring station.

There are many uses for a spectrum analyzer besides monitoring transmitter outputs, but this use alone can make an HF spectrum analyzer construction project worthwhile. If you build one, you'll probably be the first on your block (or in your favorite net or club) to have one of your own!

Spectrum Analyzer Hookup

Fig. 1 shows how to hook up the high frequency spectrum analyzer for monitoring the output spectrum of a transmitter or linear amplifier. Remember, the analyzer is a receiver. It requires a very small sample of power for operation. This is done with an L-pad sampler. The sampler will not interfere with normal transmitting or transceiving operation. The output from the L-pad is further reduced with a step attenuator to match the full-scale input-power requirements of the analyzer (1/4 to 1/10 of a milliwatt). The spectrum is displayed on the oscilloscope being used with the spectrum analyzer.

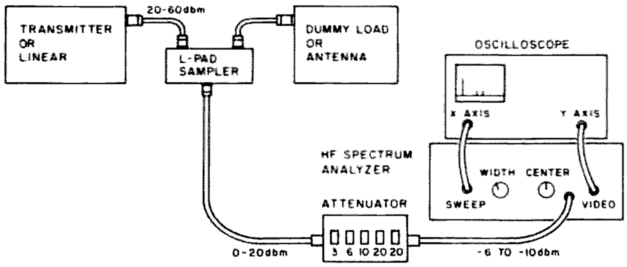
It is important to observe good safety practices when using the L-pad, attenuator, and spectrum analyzer. Be sure all station equipment, the L-pad, attenuator, analyzer, and oscilloscope cases are properly grounded. Use the proper L-pad for your power range. Double-check your hookup before applying power. If the output of a transmitter was directly connected to the analyzer by accident, it would instantly be damaged when the transmitter was keyed.

Overall Circuit Operation

Let's first discuss Fig. 2, the spectrum analyzer block diagram. We will then look at the circuits in each block in detail. Notice that the analyzer block diagram looks similar to that of a single-conversion superheterodyne receiver. The i-f frequency of the spectrum analyzer is 90 MHz.

The sampled input signal from the L-pad is adjusted to the proper power level with the step attenuator, as we discussed before. The signal is then taken through a low-pass filter with a 60-MHz cutoff frequency. The low-pass filter prevents 90-MHz signals from leaking into the analyzer and "confusing" it. The input is next mixed with the 90-MHz to 150-MHz voltage-controlled oscillator (vco) in the double-balanced mixer. The difference output from the mixer, which is the desired i-f signal, is then filtered by the 90-MHz bandpass filter. The bandpass filter provides the necessary selectivity for the spectrum analyzer. The 90-MHz signal from the bandpass filter is preamplified and applied to the log amplifier. The output of the log amplifier is logarithmic signal strength video for the oscilloscope vertical (Y) axis.

The voltage-controlled oscillator frequency is controlled by the sweep generator, which simultaneously controls the horizontal (or X axis) of the oscilloscope. Note that when the vco is



Note 1. **Never hook transmitter or linear directly to step attenuator or analyzer. Always use L-pad sampler of the proper power rating.**
Note 2. **Be sure transmitter, linear, L-pad, attenuator, analyzer, and scope are grounded.**

Fig. 1. Typical HF spectrum analyzer hookup.

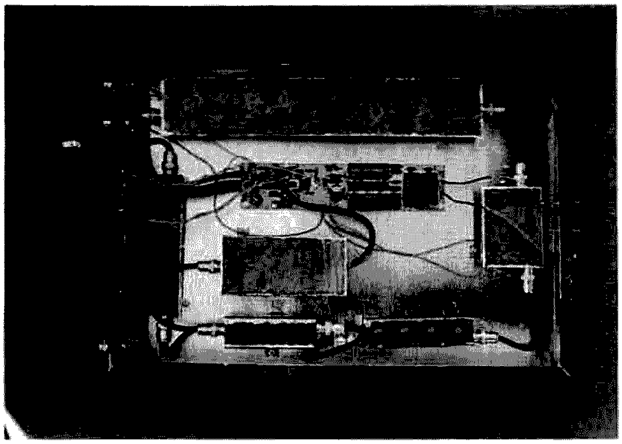


Photo D. Bottom view of spectrum analyzer chassis. Log amplifier is at the top. Power supply and sweep generator board is directly below the log amplifier. Vco is next. The mixer is directly below the vco. The mixer connects to the low-pass filter at the left. The bandpass filter is at the lower right. Preamplifier is on the middle right.

tuned to 90 MHz, the analyzer is tuned to zero MHz. When the vco is tuned to 120 MHz, the analyzer is tuned to 30 MHz. With the vco at 150 MHz, the analyzer is tuned to 60 MHz.

The tuning range of the analyzer is adjusted with the center-frequency and frequency-span controls on the sweep generator. The sweep generator automatically tunes the analyzer across its tuning range about 10 times each second. The sweep generator clamps or "shorts out" the video during the retrace between each sweep to avoid a confusing oscilloscope display. This eliminates the need for an oscilloscope with a Z-axis (blanking) input. The power supply provides +24 V dc, +12 V dc, and −6 V dc for the spectrum analyzer circuitry. The power supply operates from 12 V ac supplied by a wallplug transformer.

L-Pad

Fig. 3 shows the schematic of a 100-to-1000-Watt L-pad sampler, with alternate circuitry for a 10-to-100-Watt sampler, a 1-to-10-Watt sampler, and a 0.25-to-1-Watt sampler. Four pairs of 4.7k, 1-Watt resistors form the series element of the 100-to-1000-Watt sampler. A 51-Ohm, 1/2-Watt resistor forms the shunt element. The L-pad resistors are rated for continuous operation. A single hair-thin strand from an old "zip" cord provides some fusing protection in the event of a component failure or circuit fault. The series elements for the other power ratings are shown in Fig. 3.

0-to-59-dB Step Attenuator

Fig. 4 shows the step attenuator schematic. Five pi-style resistive attenuators are switched in or out as necessary to achieve the proper attenuation. Switches are double-pole, double-throw. Resistors may be 1/2 Watt or 1/4 Watt, although 1/4-Watt resistors are easier to work with. Note the shielding between sections. Resistors must be 5% tolerance. (The resistor values for each attenuator came from Reference 1.)

Low-Pass Filter, Mixer, and Vco

Fig. 5 shows the details of these circuits. The low-pass filter consists of three pi-sections, separated by shielding. The cutoff frequency of the filter is about 60 MHz. Three sections are used to give a high attenuation at the 90-MHz i-f frequency and above.

Each port of the double-balanced mixer is padded with 50-Ohm attenuators to

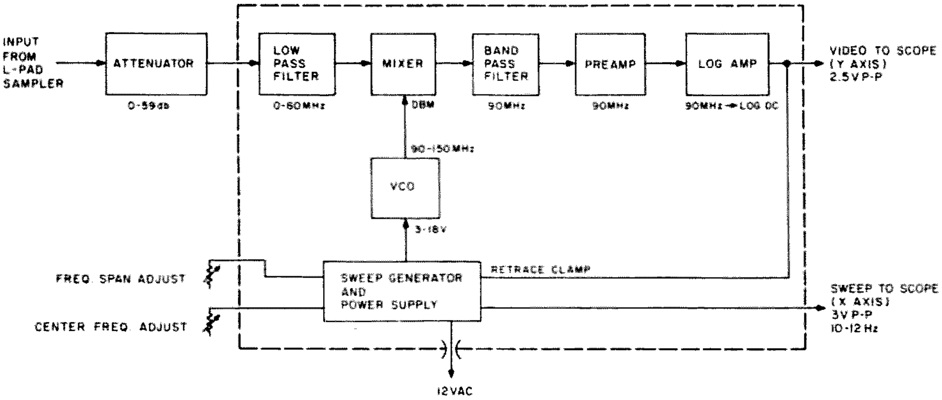
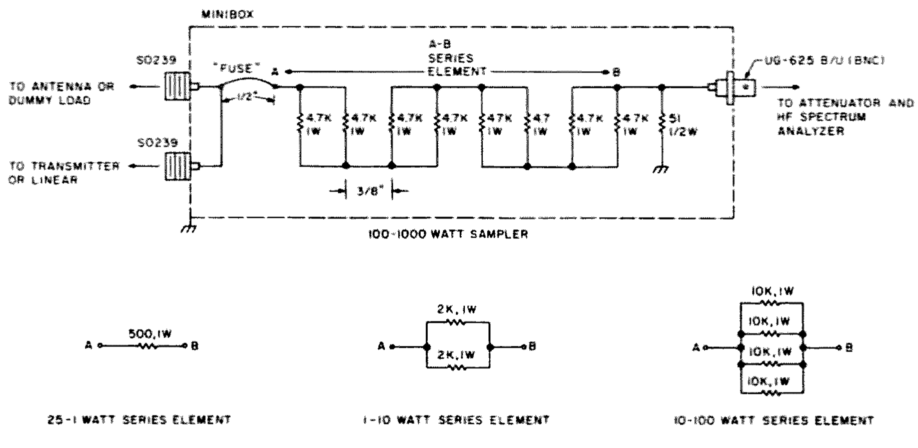


Fig. 2. Block diagram.



Note 1. Carbon composition (noninductive) resistors.
Note 2. "Fuse" is single, hair-thin copper strand from ac "zip" cord.
Note 3. Connect SO-239 connectors with RG-8 center conductor wire.
Note 4. Test-run sampler before connecting to attenuator.
Note 5. Keep BNC connector 3" away from SO-239s; space resistor sets 3/8" minimum; "fuse" is 1/2" to 3/4" long.

Fig. 3. L-pad power samplers.

encourage good mixer performance (low mixer spurs) at the expense of extra conversion loss. Mini-Circuits SRA-1 and SBL-1 are good commercial mixers. It is quite possible to build a suitable double-balanced mixer from small ferrite toroids and hot carrier diodes, if you have trouble finding these commercial units. (Consult Reference 1 for details.)

The vco consists of an MRF901 Colpitts oscillator coupled to a wideband 2N5179 amplifier. The MRF901 was eventually chosen for the oscillator transistor because of its well-behaved phase-shift characteristics between 90 MHz and 150 MHz. The two MV109 hyper-abrupt Epicap diodes act as tuning capacitors and account for the oscillator's wide tuning range. A small pick-up loop near the oscillator coil provides an output for checking frequency and doing other tests. The oscillator is also lightly coupled to the 2N5179 vco amplifier. The output of this amplifier drives the local oscillator port of the mixer. A diode-capacitor rf detector provides a dc output for checking amplifier output power. The wideband amplifier design is based on data from Reference 1. The oscillator design is based on third-attempt desperation! Note the use of the feedthrough capacitors and shielding. These are as much a part of the circuit as the MRF901.

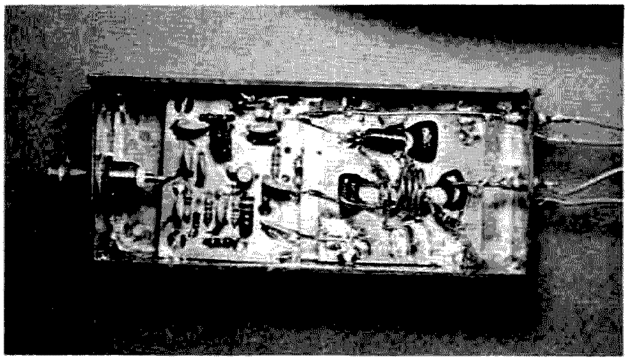
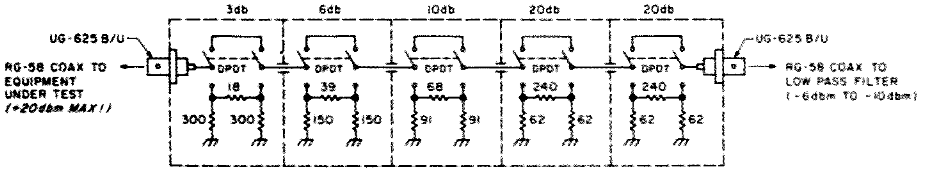


Photo E. Vco layout. Oscillator is near the feedthroughs.

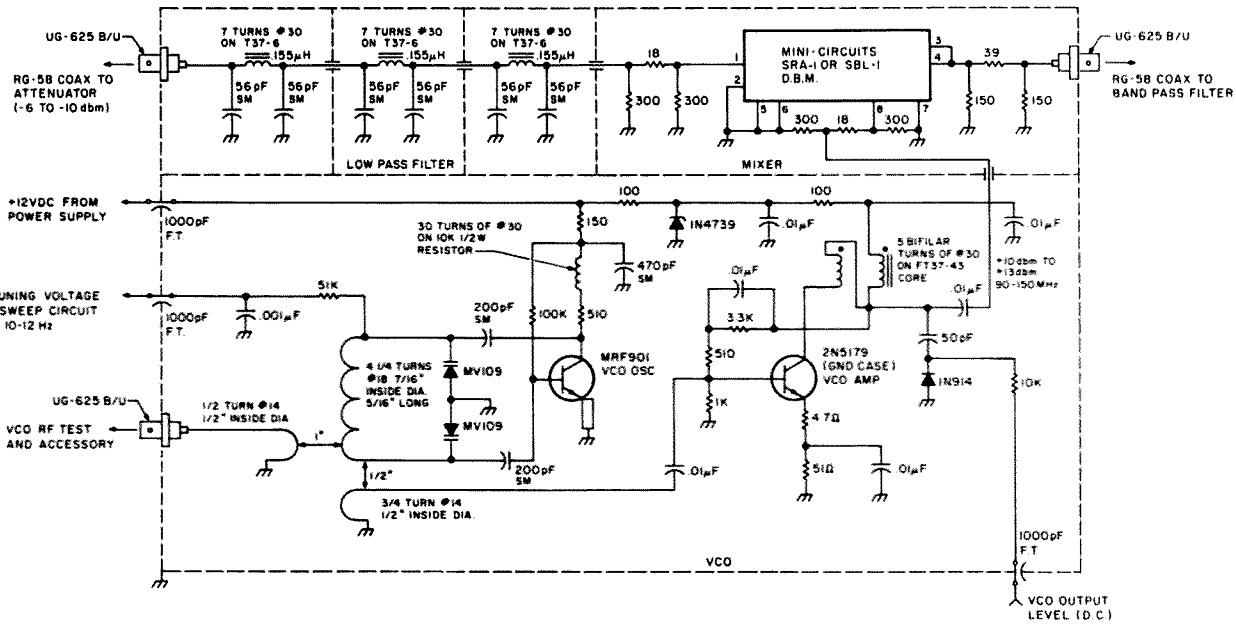
Bandpass Filter

The bandpass filter is detailed in Fig. 6. It consists of four relatively small helical resonators. The input and output resonators are tap-coupled to the input and output connectors. The four resonators are aperture-coupled to each other. The two center resonators are slightly stagger-tuned to give the filter bandpass a sharp "nose." The 3-dB



Note 1. DPDT toggle switch—Radio Shack 275-1546 or equivalent.
Note 2. BNC receptacle—Radio Shack 278-105 or Amphenol 31-236.
Note 3. Resistors 1/2 or 1/4 W, 5% noninductive.
Note 4. Attenuator box made from single- and double-sided G-10 circuit board plus copper shim stock.

Fig. 4. 0-59-dB step attenuator.



Note 1. Resistors are 1/4 W, 5%; unspecified capacitors are 50-V ceramic.
Note 2. Capacitors marked "SM" are ±5% silver mica.
Note 3. 1000-pF feedthrough capacitors available from Alaska Microwave.
Note 4. MV-209s or MV-309s may be substituted for MV-109s (contact Motorola distributor).
Note 5. Box built from single- and double-sided G-10 circuit board plus copper shim stock.

Fig. 5. Low-pass filter, mixer, and vco.

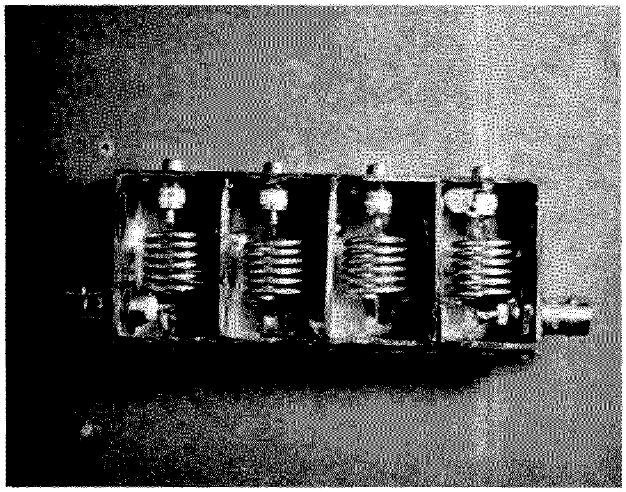


Photo F. Bandpass filter layout.

bandwidth of the filter is about 220 kHz. Insertion loss is somewhat high, but is acceptable for this application.

Preamplifier and Log Amplifier

The schematics of the preamplifier and log amplifier are shown in Fig. 7. The preamplifier consists of two wideband 2N5179 amplifiers. The log amplifier consists of six tuned 90-MHz i-f stages. Each stage uses the friendly 40673 dual-gate FET. The input stage acts as a buffer amplifier. The next five stages form the logarithmic signal-strength video detector. The log amplifier may remind you of an i-f strip in an FM receiver. In fact, it uses the limiter principle in its operation.

Notice that each stage in the log amplifier has an rf detector across its output consisting of a 50-pF capacitor, a 1N914 diode, and a 10k resistor. The rf detector on the buffer stage is just a tuning aid. The outputs of the rf detectors on the 1st through 5th log amp stages are tied to a common 1k resistor (in parallel with a 150-pF capacitor). Because of its relatively low value, the detector outputs are more or less summed across the 1k resistor.

A small input signal is amplified by all five log amp stages. Only the 5th stage will develop enough signal to provide an output from its detector. As the input signal is made larger, the 4th stage detector also will begin contributing to the output. As the output is made still larger, the 5th stage will saturate or limit. From this point it will contribute no additional voltage across the 1k output resistor. At about this same signal level, the 3rd log amp stage will begin to contribute some output, and so on. Each log amp stage provides a gain of about 12 dB until it saturates. The gain of the i-f strip, from the 1k resistor's point of view, then drops 12 dB. It is this successive limiting and dropping off of i-f stages that creates the logarithmic video output characteristic. Note that when the 1st log amp stage saturates, the log amplifier reaches its full-scale output.

I was surprised how accurately the logarithmic amplifier does track a logarithmic curve. Using my commercial step attenuator as a reference, the calibration of my logarithmic amplifier was within 1 dB. The sensitive i-f system must be shielded to prevent interference from commercial FM stations.

Power Supply and Sweep Generator Circuits

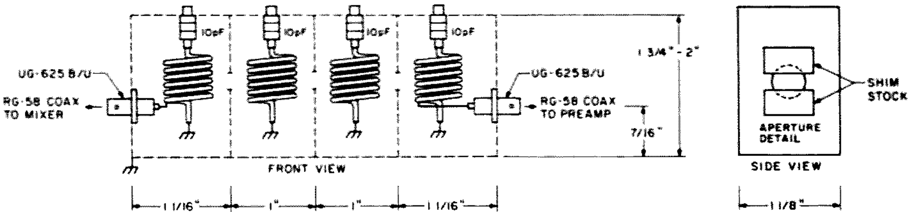
These circuits are shown in Fig. 8. The power supply is straightforward, providing +12 V dc, +24 V dc, and −6 V dc. Note the feedthrough capacitors used to filter out any rf picked up by the 12-V-ac power leads.

The heart of the sweep generator is the 555 IC timer. The two 2N2907s act as current sources. Each generates linear ramp voltages across 10-uF tantalum capacitors. The 555 synchronizes the ramps. The ramps are set at a 10-Hz-to-12-Hz repetition rate. One ramp is fed through a dc-restoring capacitor-diode clamp to the output connector for the oscilloscope horizontal (X) axis. The second ramp is fed to the 5k frequency-span potentiometer through an inverting operational amplifier buffer. The output from the frequency-span pot is summed with the output of the 5k center-frequency pot in the vco-tuning voltage amplifier. The output of this amplifier is fed to the vco-tuning voltage input.

When the ramps are reset by the 555, pin 3 of the 555 also trips the retrace VMOS clamp transistor through the retrace comparator amplifier. This shorts the logarithmic amplifier video output to ground during retrace. Otherwise, the video is fed to the output connector for the oscilloscope vertical (Y) axis. The 4th amplifier in the TL084C quad-operational-amplifier IC is used simply as a 6-V-dc reference by the other three amplifiers.

Shielded Enclosure Construction

All circuits in the high frequency spectrum analyzer except the sweep generator and the power supply must be installed in shielded enclosures. I built each enclosure for my analyzer using 1/16-inch, G-10 epoxy circuit board stock. Enclosure base plates are made from single-sided or double-sided stock. Double-sided stock must be used for the enclosure sides, ends, and partitions. (See Fig. 9 for construction details.)



Note 1. Coils are 6 turns of #12, 1/2" inside diameter, 5/8" long, taps at 1/4 turn.
Note 2. 10-pF piston trimmer, Sprague-Goodman GGP8R500 or equivalent; alternate, air-variable, Johnson 189-564-1.
Note 3. Filter box made from single- and double-sided G-10 circuit board plus copper shim stock.
Note 4. Filter box is 1-1/8" deep.
Note 5. Mount BNC connectors near front side.
Note 6. Coupling apertures are 3/8" x 3/16". Drill 3/8"-diameter holes in compartment wall pieces and then solder copper shim strips across tops and bottoms to narrow apertures.

Fig. 6. Bandpass filter.

Note the brass "cap strips." These provide a base for soldering on the thin copper (shim stock) enclosure tops. I use this method for mounting the tops so that they can be peeled back easily when I need to modify or repair circuitry. Use a 40-Watt soldering iron for soldering the enclosures together. Solder the tops on with a 25-Watt iron. Be sure the solder seams have no gaps.

Don't let the need for shielded enclosures discourage you. There are several easy, accurate ways to cut circuit board material. Beg, borrow, or buy a copy of *Printed Circuits Handbook* (Reference 4). This book does a good job of showing how to cut circuit board stock. Alternatively, make friends with a ham who owns or works at a commercial circuit board shop! Anyway, making shielded enclosures is easier than it first appears.

My original analyzer used quite a few BNC connectors. The number of connectors can be reduced by building the low-pass filter, mixer, and vco enclosures together on one base plate. Look at the schematic, Fig. 5, for shield partitioning details. Likewise, the preamplifier and log amplifier enclosures can be built together (Fig. 7). The bandpass filter should be built by itself, as should the attenuator. This arrangement allows the analyzer to be tuned up with very little test equipment.

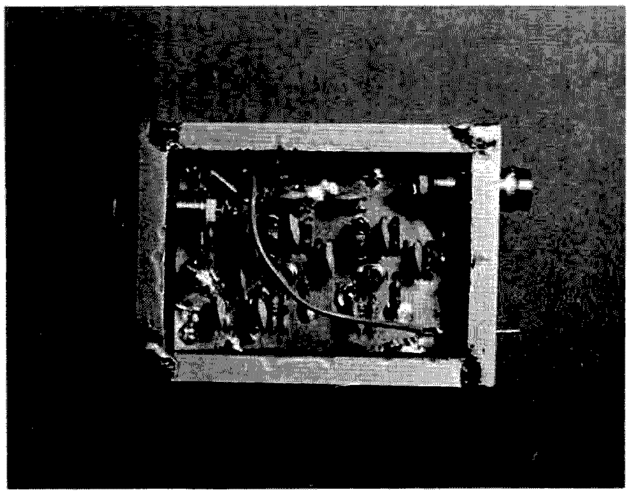


Photo G. Preamplifier layout. Note that the brass "cap strips" have been installed.

Circuit Board Layout and Construction

There are a lot of possible component substitutions for the spectrum analyzer. Some of the components you use in your analyzer will no doubt be different from the ones I used —at least in physical size. This makes standard circuit boards impractical. It is easy to lay out your circuitry for construction on single-sided circuit board stock. The copper is on the top side. It acts as a ground plane and helps stabilize the circuitry. All analyzer circuitry built in this manner was built on 1.8-inch-wide circuit board strips—lengths as needed. The low-pass filter, bandpass filter, and attenuator are built "in the air" inside their shielded enclosures. They don't need a circuit board.

Get some drafting vellum with a light blue, 1/10-inch grid on it. After you have all the parts for a circuit, you can begin developing its circuit board layout. After mulling over the schematic, lay the actual components on the grid paper and think through their interconnections. Juggle them as needed into a neat arrangement. Remember that all ground connections are going to be made on the top.

After you have the layout and interconnections visualized in an area, pick up each component and sketch in its outline on the vellum. Show its connection to other components (under the board) with dotted lines. You will be surprised how fast this goes. Remember to keep the input and output components of each rf stage separated. This is aided by using circuit board strips. Check the photos of my layout for ideas (minor circuit changes were made after some of the photos).

Once the layout is complete, tape it to your circuit board blank. Drill through the layout into the circuit board each place where a component or wire lead goes through the board. Use a #55 drill bit. After all holes are drilled, lightly countersink with a 1/8-inch drill bit all holes that are not going to be a ground connection. This keeps the leads going through these holes from shorting to the ground plane. Drill 1/8-inch holes in each corner of the board. 4-40 × 1/2-inch screws are put in these holes to act as legs for the board. Begin installing components. They are interconnected under the board by their leads and/or bus wire. Remember to keep connections as short as possible.

The vco oscillator circuit is built totally on top of the circuit board ground plane so that leads can be very short. Follow the layout in the photo carefully. The vco amplifier is built in the normal way.

I used brass tubes (bought at a hobby shop) for coil-winding mandrels. Where wiring goes through a partition on the schematics, use a 1/8-inch hole drilled in the partition wall.

After you double-check your wiring, install the circuit boards in their shielded enclosures. Tack-solder the ground plane of the circuit to one side of the enclosure. Do not install the tops of the enclosures yet—we have testing to do!

Because of the power involved, build the L-pad sampler carefully. The circuit board used to mount the resistors has no copper on either side except at the corner on the far side of the SO-239 connectors. This small piece of ground plane is covered with masking tape before the copper is etched with ferric chloride. The 51-Ohm resistor is grounded here. A ground wire is then taken from here to a lug at the BNC connector (make the lug from copper shim stock).

Mount the board using 4-40 × 3/4-inch screws. Use 5/16-inch-diameter × 1/2-inch-long aluminum tubing slipped over each 4-40 screw to stand the circuit board off. Be sure the resistor pairs are separated from each other by 3/8 of an inch. The physical layout of the resistors should look like the schematic in Fig. 3. The "fuse" wire, which is a single, hair-thin strand of copper wire from an old "zip" cord, must be at least 1/2 inch long. The L-pad is built in a medium-size minibox.

I mounted the shielded enclosures and the sweep generator/power-supply board in a 3-inch-high × 12-inch-wide × 18-inch-deep aluminum chassis. (Refer to Photo D for typical mounting.) Individual circuits are tested before final mounting and installation of the enclosure tops.

Testing and Alignment

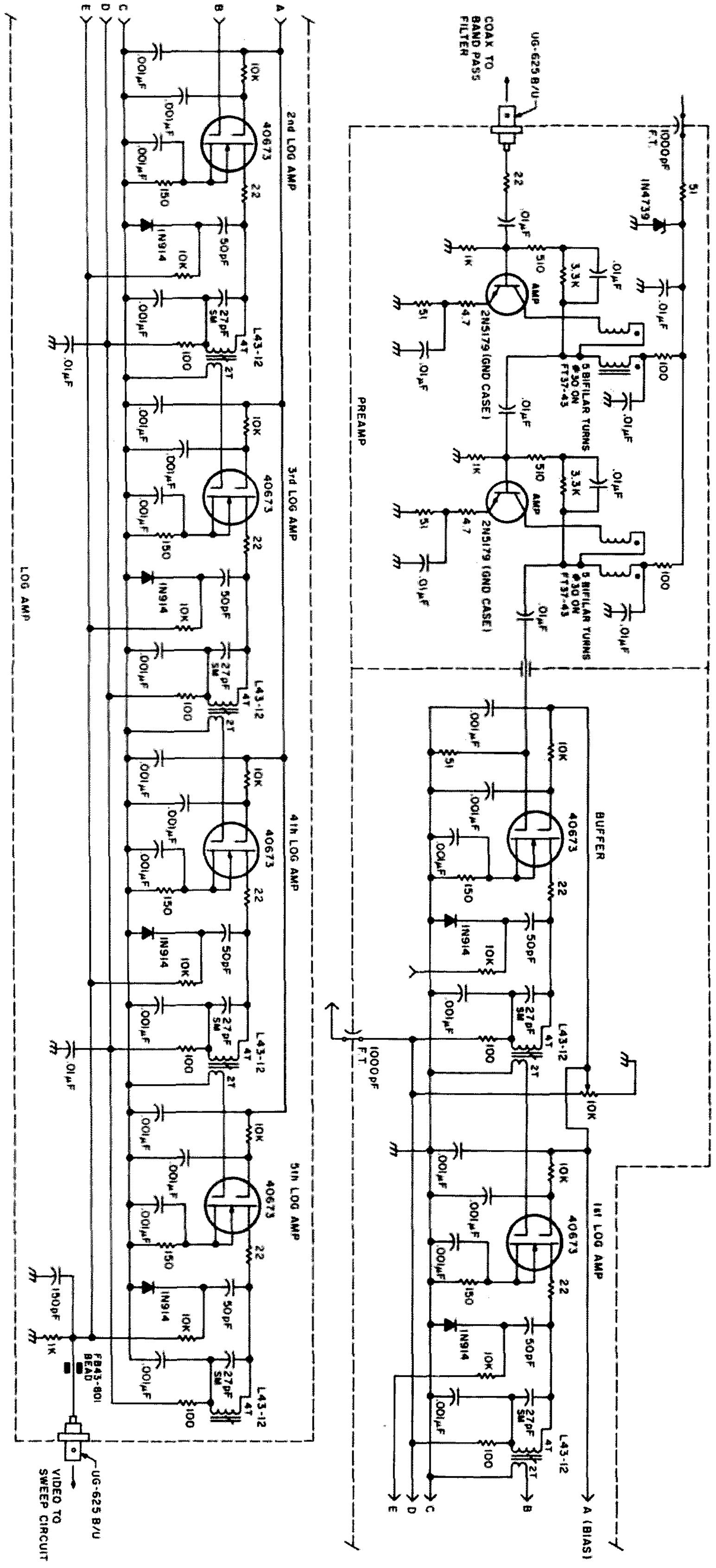
The minimum test equipment needed to align and test the HF spectrum ana-

lyzer includes a high-impedance volt ohmmeter, a 350-MHz frequency counter, and a 5-MHz bandwidth, single-channel, dc-coupled oscilloscope with a triggered sweep. A grid-dip oscillator also is useful. You should make up several 2-foot RG-58 cables with BNC connectors. These will be used during testing. For best results, testing and alignment should be done in the order listed below.

Power Supply Testing. Check the resistance between the primary and secondary of the wallplug transformer before use. It should show an open circuit. Check the secondary ac voltage. It should be 12 V ac to 15 V ac with no load. Hook the 12 V ac to the power supply and check the 12 V dc, 24 V dc, and −6 V dc outputs. They should be within 1/2 volt.

Sweep Generator Testing. Connect the power supply to the sweep generator and turn the power supply on. Check pin 2 of the 555 IC with your oscilloscope. You should find a 10-Hz-to-12-Hz ramp waveform. The bottom of the waveform should be at 4 volts and the top of the waveform at 8 volts. The front of the ramp (long slope) should appear straight. You should find a similar ramp at the X-axis output connector. This ramp will be between −0.6 volts and 3.4 volts.

Check pin 8 of the TL084C op amp. You should find a pulse train with a 10-Hz-to-12-Hz repetition rate. The pulse train should



Note 1. Resistors are 1/4 W, 5%; unspecified capacitors are 50-V ceramic.
Note 2. Capacitors marked "SM" are ±5% silver mica.
Note 3. L43-12 rf transformers and FT37-43 toroids are available from Amidon.
Note 4. Shielded box made from single- and double-sided G-10 circuit board plus copper shim stock.

Fig. 7. Preamp and log amp.

be high (20 volts) about 20% of the time and low (−3 volts) about 80% of the time.

Turn the frequency-span pot fully clockwise (no ramp) and set the center-frequency pot mid-range. You should find 6 V dc to 12 V dc on pin seven of the TL084C op amp (vco-tuning voltage). Vary the setting of the center-frequency pot. The vco-tuning voltage should vary from −3 volts to 21 volts. Set the center-frequency pot for a 10-volt output. Turn the frequency-span pot counterclockwise until you have a ramp waveform from 2 volts to 20 volts (readjust the center-frequency pot as needed). This completes preliminary sweep generator testing.

If your sweep generator fails to act as above, recheck component values and circuit hookup for problems. Refer to the theory of operation for additional hints.

Vco Testing. Connect the vco-tuning voltage from the sweep generator to the vco. Ground the RG-58 shield at the vco enclosure. Connect 12 V dc from the power supply to the vco power input. Disconnect one side of the oscillator coil for a moment. Power up and check the MRF901 collector voltage. It should be about 6 V dc to 8 V dc. If it is too high, reduce the value of the 100k bias resistor. If it is too low, increase the value of the bias resistor. You can't use a pot here! Once the collector voltage is verified, power down and reconnect the coil.

Power up and connect your counter to the vco rf test jack. Turn the frequency-span pot fully clockwise (no ramp) and adjust the center-frequency pot for a 3-volt output. Your counter should read about 90 MHz. Adjust the vco coil spacing to get the vco in the 89.5-MHz-to-90.5-MHz range. Check the dc output from the rf detector of the vco

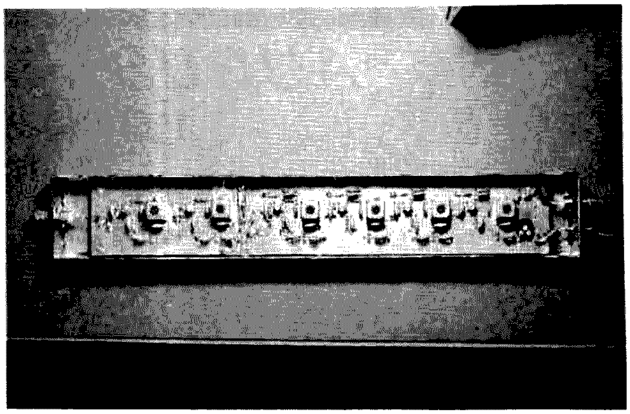


Photo H. Log amplifier layout. Note strip design.

amplifier output for a 0.8-V-dc-to-1.3-V-dc level. Adjust the spacing between the vco coil and the amplifier pick-up loop, if necessary, to obtain the proper detector output.

Set the center-frequency pot for a 150-MHz oscillator output. You should have a tuning voltage of about 18 V dc. Check the rf-detector output voltage again to be sure it's still between 0.8 V dc and 1.3 V dc. Monitoring the dc voltage from the rf detector with your scope, tune the center-frequency pot back and forth between 3 volts and 18 volts. The detector output voltage may smoothly vary some but should not "jump." An abrupt voltage change indicates a parasitic oscillation. If this should occur, work with your oscillator layout (very short leads) to get rid of it.

A tuning voltage of less than 1 V dc may cause the oscillator output to be erratic in frequency and amplitude. This is not a problem. Once the vco oscillator and amplifier are operating properly, install the vco enclosure top.

Preamplifier and Log Amplifier Testing. Connect 12 V dc to the preamplifier and log amplifier circuits and power up. Turn the frequency-span pot fully clockwise (ramp off) and adjust the center-frequency pot for 90 MHz at the vco rf test jack. Disconnect the frequency counter. Hook the attenuator box to the vco rf test jack with a two-foot RG-58 cable. Hook the output of the attenuator to the input of the preamplifier with another two-foot cable.

Set the bias pot on the log amplifier about mid-range. Monitor the dc output of the rf detector on the log amplifier buffer. Tune the buffer transformer slug for peak output. Use the attenuator to set the detector output to 0.2 V dc. Now adjust the bias pot of the log amplifier for peak output. Adjust the attenuator for a just-detectable output at the log amplifier buffer. If all seems well with the preamplifier, install the top on its enclosure. Prepare the top for the log amplifier section. Drill 1/8-inch-diameter holes in the top over each i-f transformer location and over the bias pot. (Use drafting vellum as a template.)

Hook the oscilloscope to the video output of the log amplifier. Adjust the slugs in each log amplifier stage for peak video output. The tuning of each stage should be smooth, and the tuning of the bias pot should also be smooth. If the video output from the log amplifier jumps suddenly while tuning, you may have a self-oscillation in the log amplifier. If this happens, carefully work with your layout. Ferrite beads, extra bypass capacitors, and small copper shim stock shields can be used to eliminate the problem. My i-f strip was quite stable, so I do not think you will have a problem.

If you live near a commercial FM station, it may interfere with your tuning efforts. Tape the shield top on the log amplifier during initial tuning to help eliminate this problem. As soon as it appears that the log amplifier is working, solder on the top. Once the top is soldered on, it will totally eliminate the interference.

Bandpass Filter Tuning

Set the vco to 90 MHz. Hook the attenuator between the vco rf test jack and the bandpass filter input. Hook the bandpass filter output to the preamplifier and log amplifier. Monitor the video output of the log amplifier on your oscilloscope. With the tops off the bandpass sections, you should get some signal. If not, temporarily bridge the input and output sections with a 1-pF capacitor tack-soldered at the input and output tap points. Tune the input and output stages for peak response. Remove the 1-pF capacitor if used. Now peak the two middle stages. You probably will get an overcoupled response (double-hump). Just center the tuning between the humps.

Now install the shield tops, one at a time. Tune all bandpass stages after each top is installed. Tuning will become very sharp, especially if you are using air-variable tuning capacitors instead of piston trimmers. When the last top is installed, carefully peak all stages.

Set up your oscilloscope for X-Y operation, using the X-axis output of the sweep generator for the oscilloscope horizontal input and the log amplifier video output for the vertical input. Gradually turn the frequency-span control counterclockwise until you get a sweep display of the filter

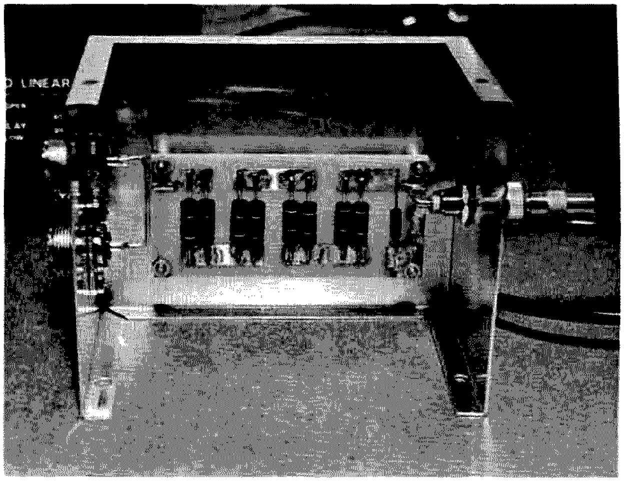


Photo I. L-pad sampler.

bandpass. Make fine adjustments for a smooth bandpass shape. Stagger-tune the two middle bandpass filter sections just a bit to sharpen the nose of the filter. Be sure to put in enough attenuation to keep the video output from the log amplifier under two volts during the bandpass filter tuning procedure.

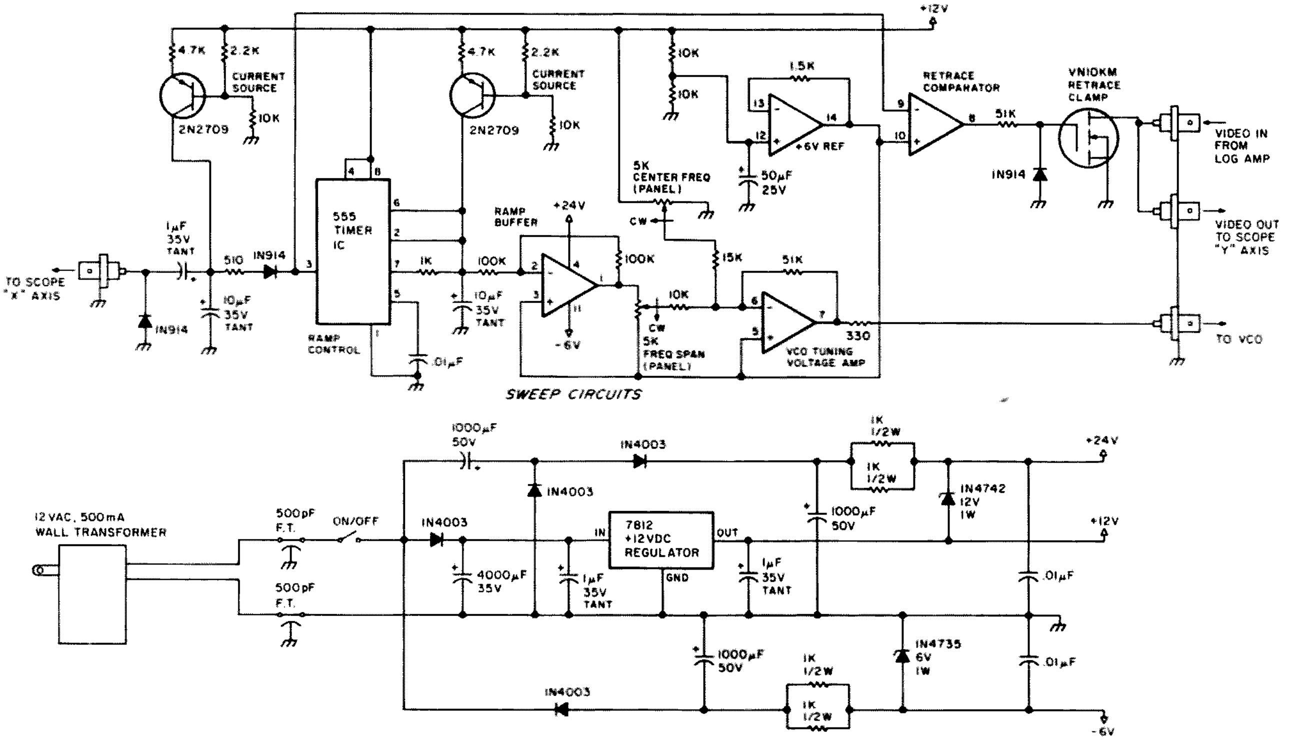
If it seems that you have an over-coupled response in your filter, narrow the aperture between the two middle bandpass filter sections. If the filter tunes sharply but exhibits high loss, then widen the aperture between the two middle sections.

Final Setup

Install all circuitry in your chassis and complete all wiring and coaxial cable hookup. Set the analyzer upside down in front of your scope. Connect your oscilloscope to the analyzer X- and Y-axis outputs. Set up the oscilloscope again for X-Y operation. Turn the analyzer on (no signal). Turn the frequency-span pot fully clockwise (no ramp). Using your frequency counter at the vco rf test jack, set the vco for 90 MHz operation with the center-frequency pot. You should see two horizontal lines about 2 volts apart. Rotate the frequency-span pot counterclockwise a little. You should see the bandpass-filter response again. This is due to mixer leak-through and is normal.

Set the retrace line (lower straight line) under the bandpass response curve at the bottom of the CRT screen. Widen the trace with the oscilloscope controls to reach across the screen. Turn the frequency-span pot fully clockwise again. Set the vco frequency to 120 MHz. Now turn the span pot counterclockwise until the zero-frequency half-spike appears on the left side of the screen. There should also be some grass above the retrace line along the bottom on the screen. The analyzer should now be scanning 0 to 60 MHz.

Feed a small 30-MHz signal from a grid-dip oscillator (use a pick-up loop as shown in Photo J) or a low-power-signal generator to the analyzer through the attenuator. You should now see the 30-MHz signal spike about mid-screen. You may also see the 2nd harmonic of the 30-MHz signal on the right edge of the screen. Adjust the attenuator so that the 30-MHz signal is about



Note 1. Wall transformer available from Jameco.
Note 2. Other devices available from Radio Shack.
Note 3. TL084C is quad op amp.
Note 4. 500-pF threaded feedthroughs available from Alaska Microwave.

Fig. 8. Power supply and sweep circuits.

the same height as the zero-frequency half-spike. If things have gone well so far, you are getting a signal through the low-pass filter and mixer, so you can now install their enclosure tops.

Set the frequency-span control so that the 30-MHz signal spike is about two scope divisions wide. Now fine-tune the bandpass filter again and re-peak the log amplifier. Switch the 10-dB attenuator section in and out while adjusting the vertical gain of the oscilloscope so that the signal height changes one CRT division. Now switch a 20-dB section in and out. Signal height should change two CRT divisions. Readjust the frequency span control for a 0-to-60-MHz analyzer tuning range.

Increase signal strength until the first small spike pops out of the grass between the 0- and 30-MHz signals. This is slightly above the overload point of the analyzer. The 30-MHz signal spike should be near the top of the CRT screen (8th vertical division). Full-scale inputs should be the next (7th) CRT division down. Touch up the oscilloscope controls if necessary. The zero-frequency half-spike will be about six divisions tall. Switch all attenuation out and reduce the signal generator output so that the 30-MHz test signal is seven divisions tall. Check the vertical calibration of the analyzer over the attenuator's 59-dB range.

Using your signal generator and frequency counter, take notes on the horizontal calibration of your analyzer. This is done by centering a signal from your signal generator on each CRT horizontal division (vertical line) and recording its frequency. Your analyzer is now ready for use. But first, test the L-pad carefully!

Hook up your L-pad to your transmitting equipment. Be sure everything is grounded properly. I suggest mounting the L-pad and attenuator on an aluminum plate which is in turn wall-mounted. Ground the plate! Do not connect the attenuator to the L-pad yet. Connect your transmitter to an swr meter, the swr meter to the L-pad, and the L-pad to your dummy load. The L-pad should introduce little, if any, swr. Starting with low power (100 Watts or less), key down for 30 seconds. Power down your transmitter completely and quickly inspect the inside of your L-pad. The "fuse" should be OK and nothing should be hot. Continue testing to full station power.

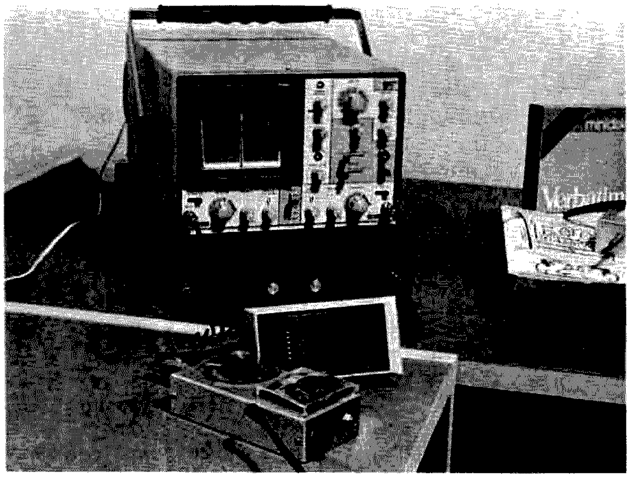
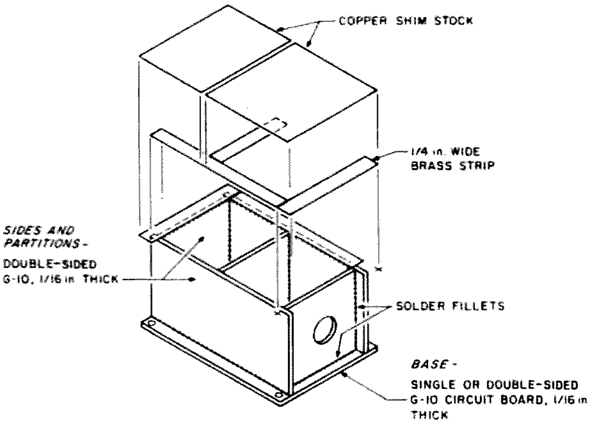


Photo J. The spectrum analyzer can easily be tuned up with simple test equipment.

If everything has gone well, then power down your transmitter completely and connect the attenuator to the L-pad. Switch in all attenuation and connect the attenuator to the spectrum analyzer. Remember that the analyzer and oscilloscope cases should be solidly grounded. Starting again with low power, key down and adjust the attenuator for a full-scale spectrum analyzer display. How does your spectrum look?! Always switch in full attenuation before increasing power. Remember, do not go over one kilowatt continuous output (2 kW p-p). Do not attempt to use the spectrum analyzer system where your swr is greater than 2:1. Always be sure you are using an L-sampler with a high enough power rating!



Note 1. Solder G-10 circuit board and brass strips with 40-W iron.
Note 2. Solder copper shim stock with 25-W iron.

Fig. 9. Shielded box construction detail.

Component Sources and Substitutions

It often is lamented that home-brewing projects is difficult these days because of poor component availability. I started seriously experimenting with electronics 20 years ago in the good old days of component availability. The difference between now and then is that we have about a thousand times more components to experiment with!

It's simply a matter of motivation and tenacity. You can get any component that you need. True, Mom and Pop's local TV component place doesn't carry everything, but they may be able to order it for you. Don't be afraid to contact a manufacturer or a big distributor like Hall-Mark, Arrow, Allied, etc. They are usually glad to work with you (although order minimums can be an occasional problem). Best of all, look at the ads in this magazine. There are several dozen mail-order distributors which market primarily to the experimenter.

On specifics: You can get circuit board stock, chemicals, drill and router bits, etc., from Kepro in Fenton, Missouri. You can get MRF901s, 40673s, 500-pF and 1000-pF feedthrough capacitors from Alaska Microwave Labs in Anchorage, Alaska. You can get ferrite beads, toroids, and i-f transformers from Amidon Associates in N. Hollywood, California. Small air-variable capacitors for the bandpass filter are available from Radiokit in Greenville, New Hampshire. You can get resistors, capacitors, 555 ICs, TL084C quad op amps, VMOS transistors, and many of the parts discussed above from Radio Shack. You can get

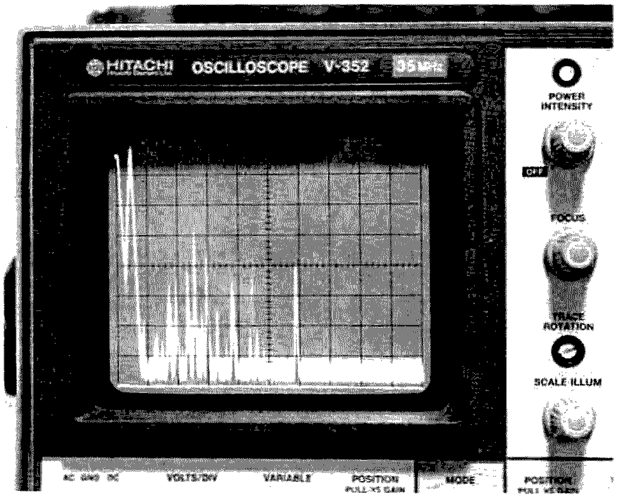


Photo K. 0-to-60-MHz spectrum on longwire antenna, using accessory preamplifier.

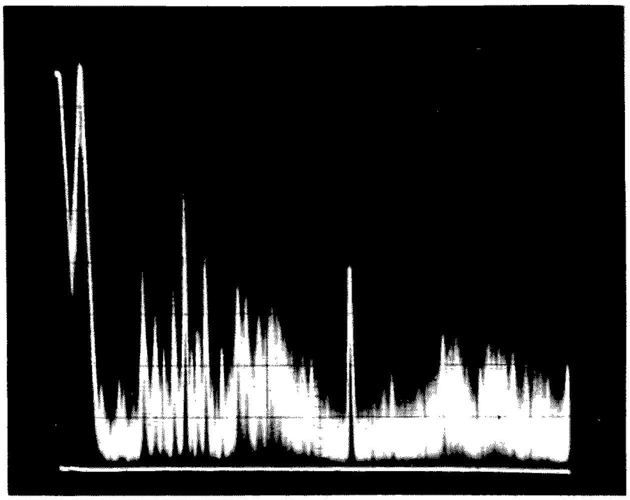


Photo L. 0-to-60-MHz spectrum on longwire antenna with my trusty but noisy computer on.

wall transformers and tantalum capacitors from Jameco in Belmont, California. 2N5179s are carried by most TV parts houses. The double-balanced mixers can be ordered directly from Mini-Circuits in Brooklyn, New York. See, you have no excuse!

OK, the MV109s might be a slight problem. An MV209 or MV309 should also work. I got my stock from Hall-Mark. If you run into a problem getting these diodes, pick up the phone and call Motorola Semiconductor in Phoenix, Arizona, for help.

The high frequency spectrum analyzer should be fairly tolerant of component substitutions except in the vco oscillator circuit and the L-pad. For example, the "hotter" 3N211 could substitute for the 40673 if you crank its gain down a bit with the log amplifier bias pot. You could use MRF901s in place of the 2N5179s (don't try to go the other way!). Solid copper conductors (#12) stripped from house wiring can be used for coil stock in the vco and bandpass filter. Any decent electrolytics of the proper capacitance and voltage rating can be used in the power supply and sweep generator circuits. Electrolytics could also be used in place of the tantalum capacitors in a pinch. Try to get close-tolerance parts in this case.

Useful Accessories

You can duplicate the 2-stage wideband-preamplifier circuit to use as an accessory ahead of the attenuator. This will allow you to view the 0-to-60-MHz radio spectrum on a longwire antenna and quickly judge the band conditions through six meters. Vco frequency-tuning is somewhat nonlinear, which is typical of simple wideband oscillators. A 6-MHz crystal oscillator driving a TTL Schmitt trigger makes a useful calibrator. The output of the TTL gate contains every harmonic through 60 MHz. Lightly couple the TTL gate to the spectrum analyzer input with an insulated wire antenna placed near the analyzer input connector. A momentary-on push-button can be used to activate the calibrator.

Analyzer Applications

We have talked about using the HF spectrum analyzer to monitor transmitting equipment. This was the primary application I had in mind when I designed the analyzer. It is especially useful to hams who are home-brewing their own HF transmitters or linears. It is also useful for checking low-pass filter performance and band conditions. I'm sure you will find other applications.

The analyzer has a 50-Ohm input impedance and is dc-coupled. Be sure to add a blocking capacitor ahead of the attenuator if you are going to look at an rf signal that is riding on a dc level. Stay away from high-voltage dc circuits. The bandpass of this analyzer is too wide for looking at SSB modulation linearity. However, this can be judged adequately from a two-tone pattern on a normal oscilloscope.

From Here

This project demonstrates that a useful spectrum analyzer can easily be built from relatively common and inexpensive components. Avid experimenters should treat this design as a starting-off point. Meanwhile, let's get those transmitter spectrums cleaned up! If you would like to ask me a question about the analyzer project, please send an SASE. 73! ■

Specifications for HF Spectrum Analyzer

Frequency range	0 to 60 MHz
3-dB bandwidth	220 kHz
30-dB bandwidth	1,100 kHz
3:30-dB shape factor	1:5
Dynamic range	60 dB
Spurious responses	60 dB below full-scale
Noise floor	65 dB below full-scale
Full-scale input	−8 dBm ±2 dBm
Y-axis output	0 to 2.5 volts
X-axis output	−0.5 to +3.5 volts
Y-axis calibration	10 dB/division
X-axis calibration	6 MHz/division (approximate)
0 to 8 MHz	4 MHz ± 0.75 MHz/division
8 to 24 MHz	8 MHz ± 1 MHz/division
24 to 60 MHz	6 MHz ± 1 MHz/division

References

1. *Solid State Design for the Radio Amateur*, by Wes Hayward and Doug DeMaw, ARRL Publications.
2. *Hewlett-Packard Electronic Instruments and Systems*, by Hewlett-Packard, Palo Alto, California, 1981.
3. "High Performance Spectrum Analyzer," Wayne Ryder, *Ham Radio*, June, 1977.
4. *Printed Circuits Handbook*, 2nd Edition, by Clyde F. Coombs, McGraw-Hill.

Lt. Col. (Ret.) Sir Evan Nepean Bt. G5YN
Goldens, Teffont
Nr. Salisbury
Wiltshire, England

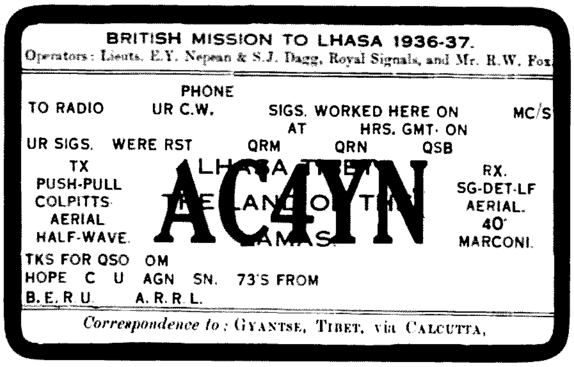
The AC4YN Story

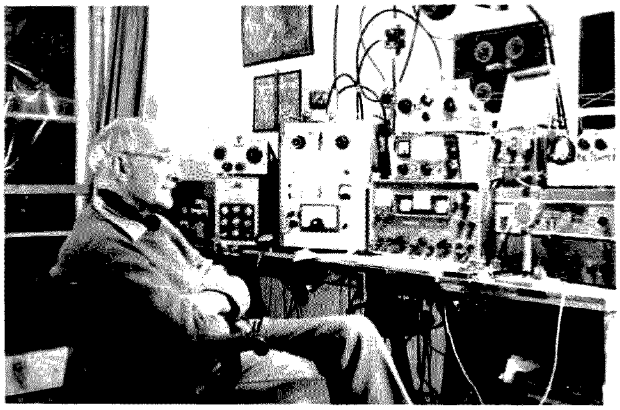
—a Tibetan adventure, circa 1936–1937

In 1936, it was decided to send a political mission to Lhasa in Tibet. I was then a subaltern in Peshawar District Signals on the northwest frontier of India.

At that time, Tibet was in a politically weak position. The Dalai Lama had died and his reincarnation had not yet been found. The Tashi Lama was on a visit to China, and the Chinese, who had always considered Tibet to be a province of China, wished to bring him back to Tibet with an escort of their army. A regent had been appointed to cover this period.

The Tibetan government, therefore, invited the mission to Lhasa with two objectives. The primary one was to persuade the Tashi Lama to return to Lhasa, to march out beyond Lhasa, meet him, and bring him back to Lhasa in triumph without an escort of the Chinese army. The second objective was for us to review the Tibetan army and advise on its improvement with a view to making Tibet a more effective buffer state between the northeast frontier of India and China.




G5YN (ex-AC4YN, VUQ, VU2YN, LA9YC, VS1YN, DL2YN) at home.

The political side of the mission was handled by the leader, the late Sir Basil Gould, who, at that time, was B. J. Gould, Esq., political officer, Sikkim, and by H. E. Richardson, Esq., British trade agent, Gyantse, the late Col. Freddy Spencer Chapman, personal assistant to Gould, and Rai Bahardur Norbhu, a high-ranking English-speaking Tibetan.

The health of the mission was in the hands of Captain W. S. Morgan of the Indian Medical Service. While the mission was in Lhasa, he also did a great deal of work for the Tibetans. He held many clinics and carried out many successful operations for cataracts under what, by modern standards, would have been considered very primitive conditions.

Military matters were in the hands of Brigadier Philip Neame VC DSO, and communications were looked after by Lieut. Sidney Dagg and myself.

Communications in Tibet were rudimentary. The Indian Posts and Telegraphs operated as far as Gyantse, where the British trade agent had his post supported by a squadron of Indian mounted infantry. Beyond Gyantse, the mail was carried by mounted runners. A telegraph line operated as far as Lhasa. It was a single strand of galvanized iron wire supported on light wooden poles with no special insulation. It operated single-current simplex earth return. One could tap in not only at Gyantse, but also at each rest house along the route. Mounted linemen patrolled the route re-erecting any poles that were blown down and repairing breaks in the line.

If we went beyond Lhasa, we would no longer have access to this circuit. It would therefore be necessary for us to take transportable wireless with which we could send back our diplomatic traffic. Another important reason for taking wireless on the mission was to outface the Chinese. They had a transmitter at Lhasa although I never heard it. As it happened, we never went beyond Lhasa. The Tashi Lama died before we succeeded in persuading the Chinese not to send an escort of their army.

The responsibility for producing radio equipment was given to Northern Command Signals; Lieut. Sidney Dagg of that regiment was given the task. As no suitable service equipment was available, he had a transmitter and receiver built in the regimental workshops

at Rawalpindi. It must be remembered that everything was carried on pack animals—ponies or yaks—in panniers two to an animal, each one not weighing more than one maud (80 lbs.).

Dagg produced the following equipment:

- The main transmitter, consisting of a self-excited push-pull Colpitts oscillator using two AT-50 triodes with an input of 100 Watts.
- A balanced Collins coupler to couple the transmitter to the open-wire aerial feeders.
- An Eddystone "All World Four" (1-V-2) battery receiver.
- A rotary transformer to convert 12 volts dc to 1000 volts dc at up to 100 milliamps.
- A Phillips record player—turntable, pick-up, and amplifier—operating on 230 volts ac.
- Two twelve-inch moving-coil loudspeakers. (We had baffles made locally on arrival.)
- One transverse-current carbon microphone.
- One 12-volt dc to 230-volt ac rotary converter.
- One 550-Watt Stuart Turner charging engine.
- Four six-volt, 120-Ampere-hour batteries.
- Two 36-foot steel sectional masts.
- Lots of aerial wire, insulators, and Eddystone 4-inch feeder separators.

I brought a few things of my own from Peshawar:

- A 1-V-1 receiver which I had built myself. This covered 10 to 550 meters using Eddystone plug-in coils. The tuning control was a Utility 100:1 slow-motion dial. The receiver proved much more efficient than the All World Four. The tuning and reaction controls were much smoother and the signal/noise ratio very much better. Much to my sorrow, I was made to leave it behind when I left the mission.

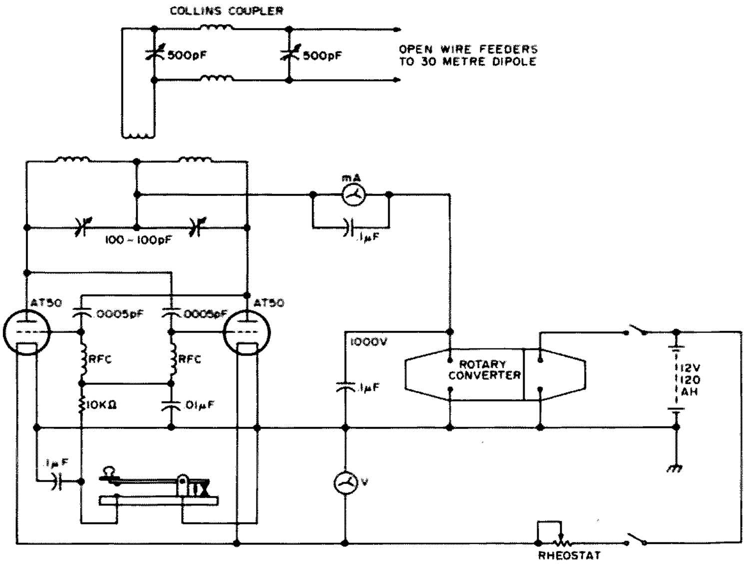


Fig. 1. AC4YN transmitter.

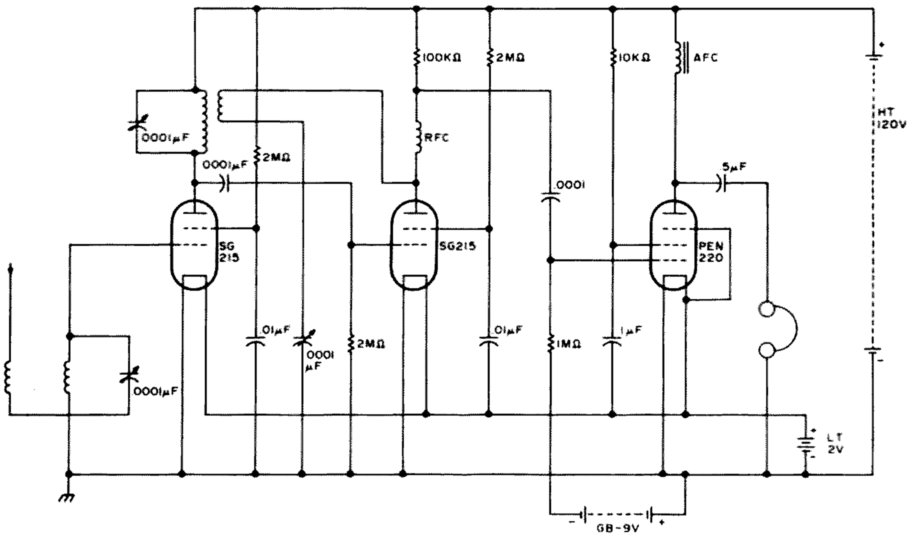
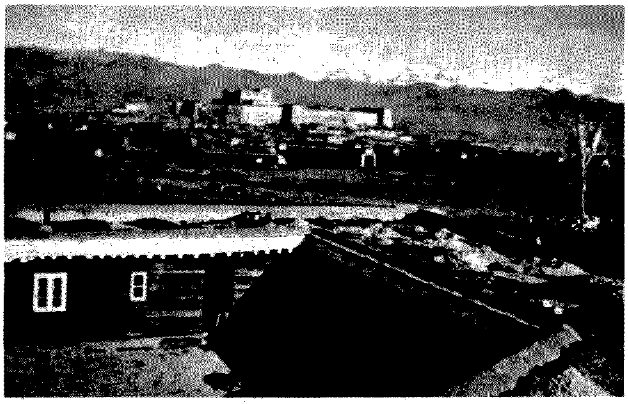


Fig. 2. AC4YN receiver.

- A simple audio amplifier ending in two PX-4 triodes in push-pull to enable my receiver to operate a loudspeaker for broadcast reception.
- 45 feet of duralumin tubular mast in 5-foot sections, the property of Peshawar District Signals. I had to leave this behind also, much to the fury of my commanding officer.
- My own key, a pair of headphones, and a small box of bits and pieces. Unfortunately, I no longer have this key as the Post Of-



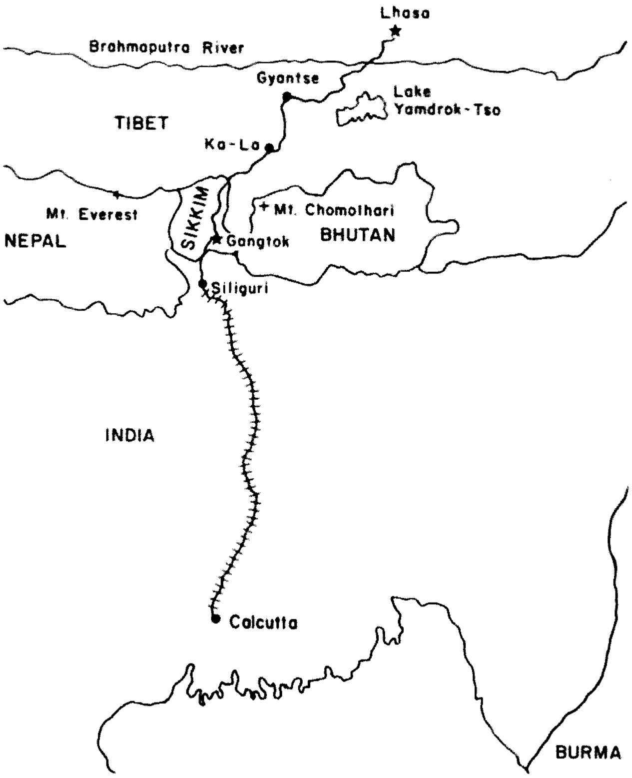
View from roof of rest house at Phari Village and jong in middle distance. Himalayas in background.

fice "lost" it when they had my equipment in custody during the last war.

Before joining the mission, I was sent to Simla, the summer hill station of army headquarters. There I gained experience in operating the control station of the army group with which we would be communicating from Lhasa. It was known as the VV group as all stations had a three-letter callsign, of which the first two were VV. The mission call was VUQ. I also was briefed to check the accuracy of *The Army Route Book of Tibet* and look out for any possible landing grounds.

From Simla, I travelled across India to Calcutta where I joined Dagg. We did some shopping and then went on to join the rest of the mission. We first traveled by train across the Plain of Bengal to Siliguri, the railhead in the foothills of the Himalayas. I chiefly remember the flatness of the country and the paddy fields.

At Siliguri, we transferred to a taxi and had a hair-raising and spectacular drive up the beautiful valley of the river Teesta. At one point, we crossed the river by a bridge which spanned a gorge in one magnificent arch, with the river racing far below. The Teesta is a tributary of the Brahmaputra.



The route from Calcutta to Lhasa. (Map from 1930s sources by Alan R. Phenix.)

We arrived safely at Gangtok, the capital of Sikkim, where Sir Basil Gould had his residency. Already at Gangtok were Freddy Chapman and Brigadier Philip Neame. Chapman not only acted as PA [personal assistant] to Sir Basil but was also in charge of cinematography, botany, ornithology, and zoology. Here, Dagg and I took the opportunity to check our radio equipment. The transmitter worked well, and we called in on the VV group. We also checked that the receivers would bring in the BBC overseas service for news, etc. We did not have time to try out the amateur bands at that time.

We then divided the equipment into 80-pound loads for back transport. The most awkward load was the charging engine, which weighed 120 lbs. In the Army, this was carried as a top load on a Class I mule. However, we had no proper pack saddles and the ponies would not have been strong enough. Finally, it was lashed to two stout bamboo poles and carried by four coolies.

When we set off, our entourage down to the last servant and sweeper was 50 strong, including 25 pack animals and their drivers. These were ponies at first and yaks later. In those days, the motor road ended at Gangtok, so from then on we either walked or rode.

As far as the halfway point, Gyantse, there were good rest houses at each stage in which we could spend the night in comfort. The first day's journey was through rain forest, where rhododendrons grew in thirty-foot trees and leeches abounded. The first halt was at Karponang at 9,500 feet, just short of the Tibetan border. I remember suffering from mountain sickness here, but it passed off in about half an hour.

Next day, we crossed into Tibet by the Natu La Pass at 14,600 feet and dropped down into the Chumbi Valley. Over the pass it was much dryer as the monsoon drops most of its moisture on the southern slopes of the Himalayas, leaving Tibet a comparatively dry country with only a few inches of snow despite a very hard winter.

Lieut. Dagg unpacks and tests record player at an intermediate halt. Freddy Chapman at right.

How the charging engine traveled to Lhasa.

In the valley, we spent three nights, one at Champitung, 13,350 feet, another at Yatung, 9,950 feet, and a third at Gautsa, 12,600 feet. At Yatung there was a detachment of Indian mounted infantry. The next day we climbed up out of the valley on to the main Tibetan plain at 14,300 feet. We stopped the night at Phari, which was a small town with a fort, or jong, and a good rest house.

At each of these halts, Dagg and I set up a receiver to check on the VV group and take down news broadcasts from the BBC. It was a year after sunspot maxima, so HF propagation was good and there was nothing unexpected about what we heard. The only embarrassment was the charging engine. Dagg had been given no chance to test it at high altitude, and as we gained height, it developed less and less power due to shortage of oxygen. At 6,000 feet it would just work. At 10,000 feet it would start and run when cold. As soon as it warmed up it stalled, and that was that.

We sent a signal home to Stuart Turners who, in due course, sent out a pair of variable-jet carburetors. They did not arrive until after I had left the mission, but I was told that when they were fitted the engine ran very well, developing more than its rated power.

Tibetans working the hand charger.

The transmitter, receiver, and Collins coupler installed in the barracks at Gyantse.

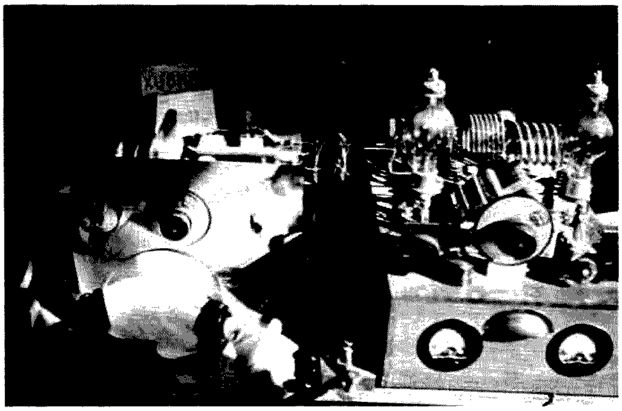
While Dagg and I were dealing with radio matters, Chapman was studying the local fauna and flora. In due course, he sent back a magnificent collection of seeds and pressed flowers to Kew Gardens.

There were six more night halts before reaching our major intermediate halt at Gyantse: Tuna, 15,000 feet, Dochen, 14,900 feet, Kala, 14,850 feet, Samada, 14,100 feet, Kangmar, 13,900 feet, and Saugang at 13,000 feet. Gyantse itself was at 13,100 feet. The way was mainly over a stony plain with mountains rising to 20,000 feet in the distance. Sometimes we passed through rocky gorges and occasionally by streams. We passed close under Mt. Chomolhari, a beautiful snow-covered cone rising to 24,000 feet.

Gyantse is a fair-sized town with monasteries, a jong, the headquarters of the British trade agent, and barracks for a company of Indian mounted infantry, at that time the 2/7 Rajputana Rifles. Here several official receptions took place. For instance, we had to time our arrival carefully so as to be three miles from the town at 11:00 am. We were met here by Raja Tering, a cousin of the Maharajah of Sikkim. Half a mile further on, we were met by Mr. Richardson (the British trade agent), Capt. Salomons, an escort of mounted infantry, and Capts. Guthrie and Morgan of the IMS, the Army surgeons. Captain Morgan accompanied us for the rest of the mission. A mile further on, the eastern and western jongpens met us, and finally the Tibetan trade agent and the Abbot of Gyantse Gompa. This order of precedence is very strict. The most senior official meets you nearest your destination and the most junior farthest out. On each occasion, ceremonial scarves of white natural silk are exchanged.

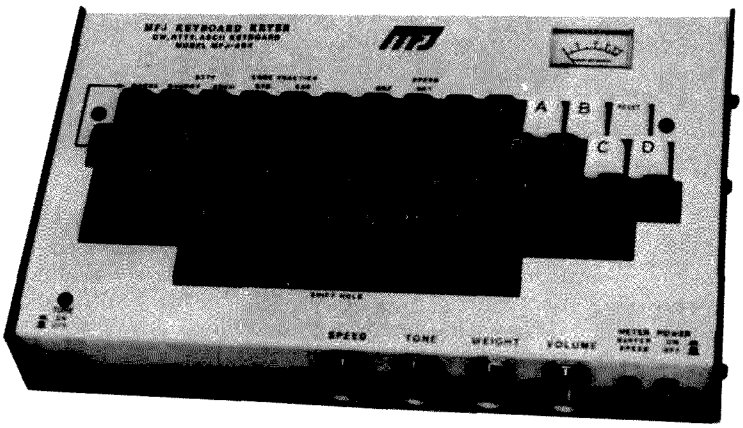
Here, Dagg and I were able to have a thorough sort-out of our gear. We cut

View of my tent, home of AC4YN, in the garden of the Dekiy Langka at Lhasa.



The transmitter and receiver, VUQ/AC4YN, in my tent at Lhasa.

MFJ Super Keyboards



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MFJ brings you a pair of 5 Mode Super Keyboards that gives you more features per dollar than any other keyboard available. You can send CW, Baudot, ASCII. Use it as a memory keyer and for MORSE code practice.

You get text buffer, programmable and automatic message memories, error deletion, buffer preload, buffer hold, plus much more.

MODE 1: CW

The 256 character (50 for 494) **text buffer** makes sending perfect CW effortless even if you "hunt and peck."

You can preload a message into the buffer and transmit when ready. For break-in, you can stop the buffer, send comments on key paddles and then resume sending the buffer content.

Delete errors by backspacing.

A meter gives buffer remaining or speed. Two characters before buffer full the meter lights up red and the sidetone changes pitch.

Four programmable message memories (2 for 494) give a total of 256 characters (30 for 494). Each message starts after one ends for no wasted memory. Delete errors by backspacing.

To use the **automatic messages,** type your call into message A. Then by pressing the CQ button you send CQ CQ DE (message A).

The other automatic messages work the same way: CQ TEST DE, DE, QRZ.

Special keys for KN, SK, BT, AS, AA and AR.

A lot of thought has gone into human engineering these MFJ Super Keyboards.

For example, you press only a one or two key sequence to execute any command.

All controls and keys are positioned logically and labeled clearly for instant recognition.

Pots are used for speed, volume, tone, and weight because they are more human oriented than keystroke sequences and they remember your settings when power is off.

Weight control makes your signal distinctive to penetrate QRM.

MODE 2 & 3 (RTTY): BAUDOT & ASCII

5 level Baudot is transmitted at 60 WPM. Both RTTY and CW ID are provided.

Carriage return, line feed, and "LTRS" are sent automatically on the first space after 63 characters on a line. This gives unbroken words at the receiving end and frees you from sending the carriage return. After 70 characters the function is initiated without a space.

All up and down shift is done automatically. A downshift occurs on every space to quickly clear garbled reception.

The buffer, programmable and automatic messages, backspace delete and PTT control (keys your rig) are included.

The ASCII mode includes all the features of Baudot. Transmission speed is 110 baud. Both upper and lower case are generated.

MODE 4: MEMORY KEYER

Plug in a paddle to use it as a deluxe full feature memory keyer with automatic and programmable memories, iambic operation, dot-dash memories, and all the features of the CW mode.

MODE 5: MORSE CODE PRACTICE

There are two Morse code practice modes. Mode 1: random length groups of random characters. Mode 2: pseudo random 5 character groups in 8 separate repeatable lists (with answers).

Insert space between characters and groups to form high speed characters at slower speed for easy character recognition.

Select alphabetic or alphanumeric plus punctuation. You can even pause and then resume.

MORE FEATURES

Automatic incrementing serial number from 0 to 999 can be inserted into buffer or message memory for contests.

Repeat function allows repetition of any message memory with 1 to 99 seconds delay. Lets you call CQ and repeat until answered.

Two key lockout operation prevents lost characters during typing speed bursts.

Clock option (496 only) send time in CW, Baudot, ASCII. 24 hour format.

Set CW sending speed before or while sending.

Tune switch with LED keys transmitter for tuning. Tune key provides continuous dots to save finals. Built-in sidetone and speaker.

PTT (push-to-talk) output keys transmitter for Baudot and ASCII modes.

Reliable solid state keying for CW: grid block, cathode, solid state transmitters (-300V, 10 ma Max, +300V, 100 ma Max). TTL and open collector outputs for RTTY and ASCII.

Fully shielded. RF proof. All aluminum cabinet. Black bottom, eggshell white top. 12"Dx7"Wx1¼"H (front) x3½"H (back). Red LED indicates on.

9-12 VDC or 110 VAC with optional adapter.

MFJ-494 is like MFJ-496 less sequencial numbering, repeat/delay functions. Has 50 character buffer, 30 character message memory. Clock option not available for MFJ-494.

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Using the PA equipment. The monk who enjoyed singing.

The Regent inspects the record player/PA equipment.

Ringang.

a dipole for the Army HQ group wavelength of 30 meters. Each half of the dipole was 25 feet long, and the open-wire feeders were 40 feet long. We set up the transmitter and receiver in a room in the barracks. We were lucky enough to find here a home-made charging machine which had been built to charge the battery of a broadcast receiver. It was built around a six-volt car dynamo driven by a wondrous contrivance of wooden pulleys and flapping leather belts. Cranked by coolies, it managed to produce enough charge to enable us to maintain short schedules with the VV group, but not enough to spare to enable us to make any transmission on the amateur bands.

It was now decided that Dagg should go back to Calcutta and have a new handcharger built. It had been hoped that a charging engine used by a recent Everest expedition might still be available at Katmandu, but enquiries showed that it had been disposed of. Dagg eventually rejoined us in Lhasa with a most efficient gear-driven device. It used a Ford 12-volt dynamo and had two large crank handles. Four coolies managed to produce 6 Amps through 12 volts of batteries. This rate of work is only about 1/10th HP, so they can't have been working very hard!

The political part of the mission went ahead to Lhasa, leaving me behind with the radio gear and the Bell and Howell 35mm projector. There was no point in taking these on up to Lhasa until power was available. In due course, I was summoned to join the main party.

Now, Lhasa had an electric light plant. It worked on the dc three-wire system with 440 volts of batteries having the center tap earthed. The supply was, therefore, 220 volts. Those on one wire had positive earth, those on the other had negative earth. The cells were charged by a motor generator. The motor ran at 3 kV ac. The ac was generated by a small hydroelectric plant in the foothills of the 20,000-foot mountains which rose from the 12,000-foot Lhasa plain about three miles away.

The insulation of the transmission line was a bit rudimentary, and on damp evenings there were impressive brush discharges. The stream driving the turbine froze at night during the winter so that charging could be carried out only by day.

You will realize that this was a considerable engineering achievement when you remember that every item had to be carried up from the road head by coolies and pack animals. Great credit also is due to the Tibetan official who assembled and commissioned it with only unskilled labor at his disposal and who was responsible for running it. His name was Ringang. He was one of the four Tibetans who, as boys, were sent to England and educated at Rugby. He was also responsible for the official ciphers. He arranged for our batteries to be charged by connecting them in parallel with the end cells of the 440-volt battery.

The mission was accommodated in a nice villa in a garden called the Dekiy Langka. There were not enough rooms for us all to sleep inside, so I had a tent in the garden in which I also set up the transmitter and receiver. The aerial was supported at one end on a forty-foot mast consisting of five of the eight-foot sections of duralumin. The other end was supported on one section set up on the flat roof of the house. Regular contact was kept with the control station of the VV group at Army headquarters, Simla, in the summer, and with New Delhi in the winter. All the outstations at various army stations in India and the one in Hong Kong were worked on the 30-meter wave.

Once this was organized, I looked around for the 20-meter amateur band. This was soon found and the transmitter tuned to the band by netting on to the receiver. You will remember that each half of the dipole was 25 feet and the feeders were 40 feet, making the overall length of each half 65 feet, so there was no problem in loading it up via the Collins coupler.

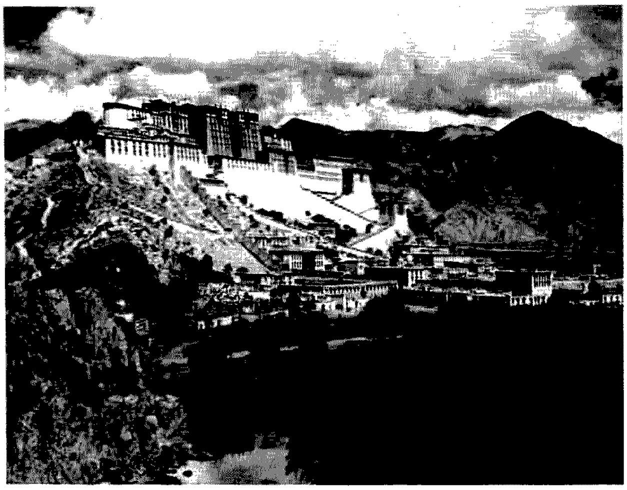
The first people to respond to that historical call, "CQ de AC4YN," were VU2 amateurs. Before the Chinese invasion, the intermediate for Tibet was AC4. There was no licensing authority, so I created the call by adding the two letters of my own callsign to the intermediate. Unfortunately, I did not make a copy of the log for my own records, so I have no recollection of individual callsigns worked.

The first DX to be worked was VK and ZL. They were so reliable that we regarded them as locals. This was very useful, as the political officer had relations in New Zealand. We were able to pass Christmas greetings between the two parties via amateur radio, earning considerable kudos both for amateur radio and Royal Signals.

As the year progressed, our signals seemed to reach further and further west until, in December, I raised my first G station. In my excitement, I asked him if he would relay messages to my family. However, I must have scared him off as he did not come back to me again.

I was not able to spend much time on the air as I had to join in a great number of the business and social activities of the mission. We attended and gave many official parties. There were visits to the Potala, the three huge monasteries (Sera, Drepung, and Kundun), the cathedral, and various temples. Although the Tibetans are Buddhists, there were still traces of ancestor and devil worship. It was always considered wise to placate any gods, spirits, or devils that may be around. One such temple was dedicated to snakes.

Besides these places, we also visited the mint, the arsenal, and the Norbu Lingha, the Dalai Lama's summer palace and gardens. Some of my time also was taken up helping Freddy Chapman with cipher work and photography. On some evenings, we gave cinema performances. These were always packed, not only with our own staff and friends, but also by as many locals as could squeeze into the room. Some of the films were old comics we had rented from a film library and brought with us. Of these, the most popular were those starring Rin Tin Tin, since they reminded locals of their own shepherd dogs.



The Potala.

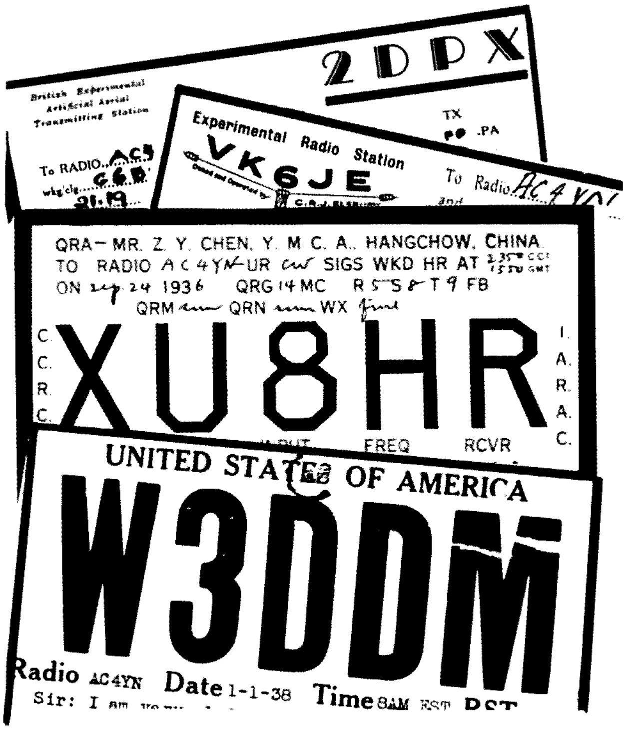
What they enjoyed most were films taken by Chapman which had been sent down to Calcutta for processing and returned to us. The appearances of themselves and their friends on the screen were greeted with loud applause. Another thing which amused them was talking into the microphone and hearing their own voices, amplified by the record player amplifier, booming out over the loudspeakers.

All too soon, the time came when I had to leave Lhasa, the mission, and all the good friends I had made up there. A frontier war had started and my commanding officer demanded my return to the regiment. So, about mid-December, I set off back with my Pathan bearer and a couple of pack ponies. Traveling light, I did double stages. Chapman came with me as far as the Yamdrok So, a vast lake between Lhasa and Gyantse, to study bird life and gather wild flowers. I crossed the upper reaches of the Brahmaputra in coracles, came back over the 16,600-foot Karo La, and went down to Gyantse. In winter, it is very cold at these heights, and a strong wind blows all day raising dust storms. If Tibetans have to travel in the winter, they do so at night when the wind drops.

I continued these double stages back to Gangtok, and then went by taxi to Siliguri and by train to Calcutta. I had to call in at New Delhi for debriefing before returning to my regiment in Peshawar.

In order to keep the radio in operation after my departure, Reg Fox, who was ex-Royal Signals, was sent up from Calcutta. He did not arrive until after I left, so I did not have the pleasure of meeting him. When the mission closed in the spring, he stayed on in Lhasa and married a Tibetan girl. He remained until the Chinese invasion, when he escaped to India where he died. Whether any of his records, logs, or equipment have survived, I do not know.

To those who are interested in reading about the mission, I recommend F. Spencer Chapman's book *Lhasa, The Holy City*, published by Chatto and Windus, London, 1938. The political officer in Sikkim's letter no. 4(7)-P.37 to the Foreign Office (dated 30th April 1937) and his diary of events are probably available from the Public Record Office, London. ■



"Smart" Squelch for SSB

Editor's Note: W9MKV and W9YAN's "Smart Squelch" overwhelmed the competition to win the first *73 Magazine* Home-Brew Contest. The authors received a $250 prize in addition to the normal article payment. You can build this trend-setting project; W9MKV offers a PC board for $7.00 and a complete parts kit is available from Radiokit, Box 411, Greenville NH 03048, for $49.95. Congratulations to W9MKV and W9YAN for a job well done.

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Bloomington IN 47401

This circuit detects the human voice but ignores noise, steady tones, and the Russian woodpecker HF radar pulses. It requires no receiver modification and works even when voice signals are below the noise level.

A squelch turns off receiver audio to eliminate annoying background noise when there is no signal. Squelch circuits in AM and FM receivers are carrier-operated. On single sideband, which has no carrier, squelching is more difficult. Most SSB rigs with squelch, e.g., the popular 2-meter multimode transceivers, use agc (S-meter) voltage to open squelch in SSB mode. Agc-operated squelch is adequate for strong signals on relatively quiet channels. Agc and VOX-type squelches open for any noise or heterodyne that exceeds a preset level. Weak signals often are missed because the threshold must be set above the noise level.

White noise sometimes can make you imagine tiny voices in the noise, but it won't fool the Smart Squelch. Detecting unreadably-weak signals is worthwhile if a change of antenna direction or receiver control settings will make them usable.

The audio-operated squelch circuit described here is similar in principle to Motorola's "Constant Sinad" squelch, a discrete-component circuit with 22 transistors.

Discriminating the Human Voice

People normally speak about three syllables per second. The squelch works by detecting voice-band energy (500-3000 Hz) which is varying in frequency at a *rate* of 0.5 to 3.25 Hz.

The circuit is a type of FM detector. It is insensitive to amplitude variations throughout the range where the input stage is not driven to saturation but background noise is strong enough to saturate the limiter. The squelch works properly with most speaker-level signals. You can connect it directly to the receiver's detector output, adjusting gain of input buffer amplifer U1A as necessary.

Performance

A receiver tuned to WWV provides a good demonstration of the circuit's capabilities. Squelch opens for voice announcements and ignores the rest of the transmissions.

The squelch can turn on well within the first spoken syllable. Speed of response depends mostly upon the rise-time of active low-pass filter U3A. The receiver is muted one second after the last voice detection. The beginning of a steady tone

Photo A. Squelch unit is attached to the right side of the HF SSB transceiver. Rectangular LEDs above the control knob indicate circuit status. (Photo by KA9FJS)

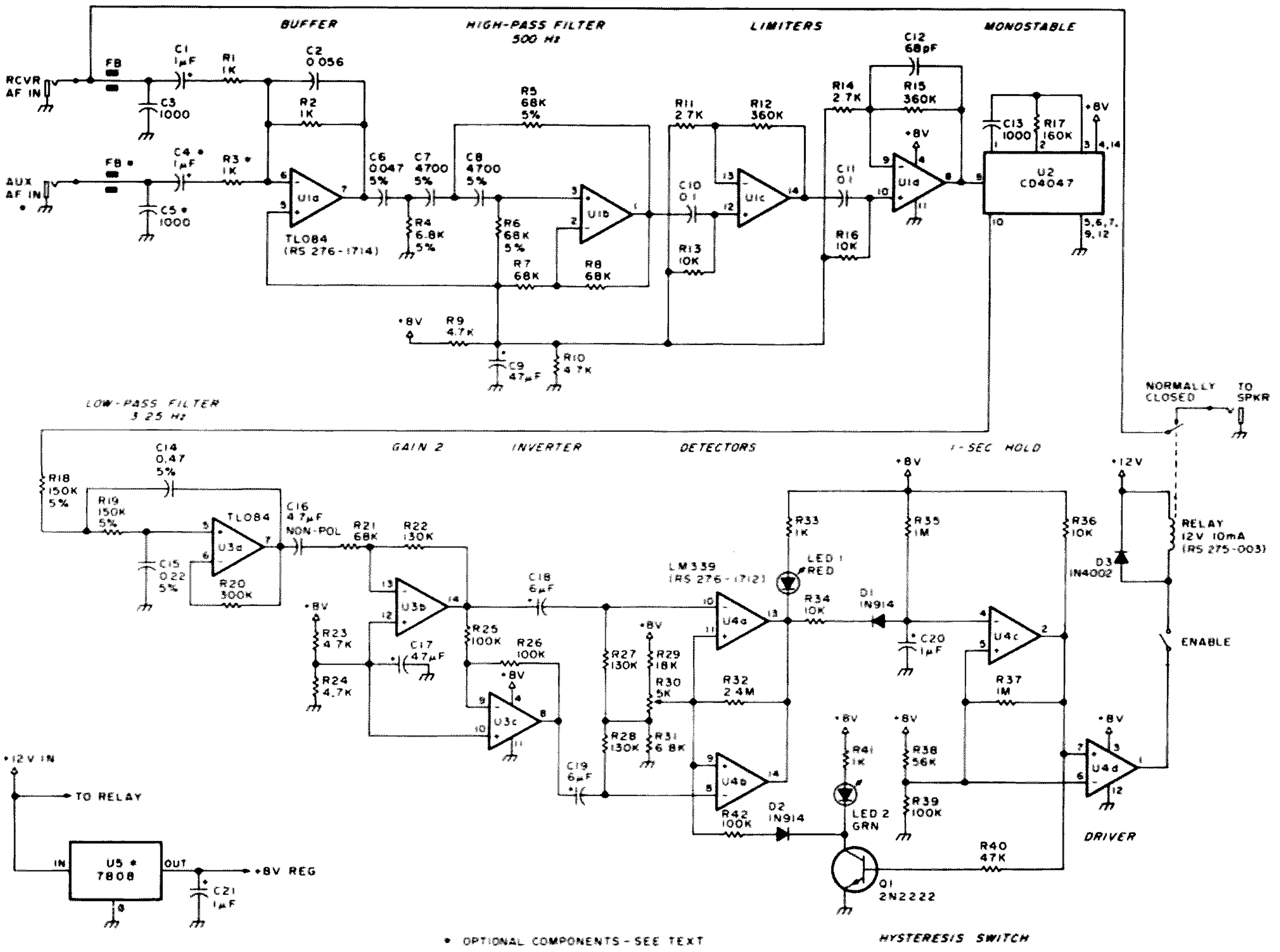

Fig. 1. Schematic diagram.

opens the squelch only momentarily. It opens intermittently on music. Response to CW depends on code speed and tone.

A single squelch circuit can control multiple receivers, unsquelching them all when any receiver detects a voice signal. (We like to monitor HF aircraft and marine frequencies plus 144.2 MHz—the 2-meter SSB calling frequency.)

The squelch is useful when rf radiation from computer systems overwhelms the normal squelch in a VHF FM receiver. It's also good for monitoring VHF/UHF mobile-telephone channels in systems where a constant idle tone is transmitted while no call is in progress. The circuit has other applications as a "smart" VOX (voice-operated switch) for transmitters, recorders, intercoms, security systems, remote-base systems, and repeater equipment.

Circuit Description

U1A is a unity-gain summing amplifier, input buffer, and low-pass filter with 3-kHz cutoff. U1A drives U1B, a third-order high-pass active filter with 3-dB cutoff at 500 Hz. We chose high-performance FET-input operational amplifiers so that active filters could use high resistances and small capacitors. The TL084 quad op-amp chip is equivalent to the National LF357.

U1C and U1D are limiter amplifiers with a combined gain of 85 dB. U1D's output is voice-band audio turned into constant-amplitude square waves. The square waves trigger CMOS monostable multivibrator U2. Output of U2 is a train of .33-millisecond pulses, one for each audio cycle. The *average* voltage of U2's output is proportional to the input *frequency*. U2 and the following low-pass filter form a frequency-to-voltage converter, i.e., FM detector, somewhat similar to an automobile tachometer circuit.

Active low-pass filter U3A cuts off at 3.25 Hz, the best compromise between noise-falsing and the rate at which people speak syllables.[2] Note that U3A has no bias network even though the amplifier uses a single-polarity power supply. U2's averaged pulses keep the output of U3A at 5 to 6 volts with normal noise input from the receiver. R17, which sets U2's period, can be varied to keep U3A's quiescent output voltage near the center of its range.

On very quiet channels there may not be enough pulses from U2 to keep U3A properly biased. False detects may occur as U3A's output goes in and out of its linear range. You can inject extra noise or low-level tone into the squelch circuit's auxiliary input to achieve the desired results for your particular application.

U3A's output is ac-coupled to U3B, which amplifies with a gain of 2, and thence to U3C, a unity-gain inverter. U3B and U3C together form a phase splitter with a gain of 2. The phase

splitter provides positive-going outputs for positive *and* negative frequency deviations of the receiver audio.

Comparators U4A and U4B detect the rate-of-change-of-frequency signals from the phase-splitter outputs. If the voltage at the inverting (−) input of U4A *or* U4B exceeds the reference voltage set by squelch-threshold control R30, then the low-going level at the comparators' paralleled open-collector outputs discharges C20 through R34 and D1. The discharge time constant is 10 milliseconds. C20, R35, and comparator U4C form a time-delay circuit which holds squelch open during its one-second period. Each detector output longer than 10 milliseconds resets the timer for another one second. R35 controls length of delay.

U4C's output is the squelch-open signal (active high). U4C turns on hysteresis-switch transistor Q1 (which lights LED2) and activates output-driver U4D. As shown, U4D's output goes high to unsquelch. We used normally-closed relay contacts so that the speaker is enabled when the relay is turned off or if power is removed from the squelch circuit. To reverse the sense of the output, exchange the (+) and (−) inputs of U4D. (Jumpers are provided on the PC board.) U4D's open-collector output can drive a relay in the speaker lead, as shown, or a gated amplifier, analog gate, optoisolator, or TTL or CMOS logic circuit. The comparator output can sink 50 mA maximum.

The squelch is more sensitive *after* opening than before. The sensitivity change is called *hysteresis*. With no hysteresis, the squelch may drop out while someone is talking. If there is too much hysteresis, squelch threshold becomes hard to adjust properly. Detector comparators U4A and U4B have two levels of hysteresis. Positive-feedback resistor R32 prevents comparator oscillation and lowers the threshold slightly during a

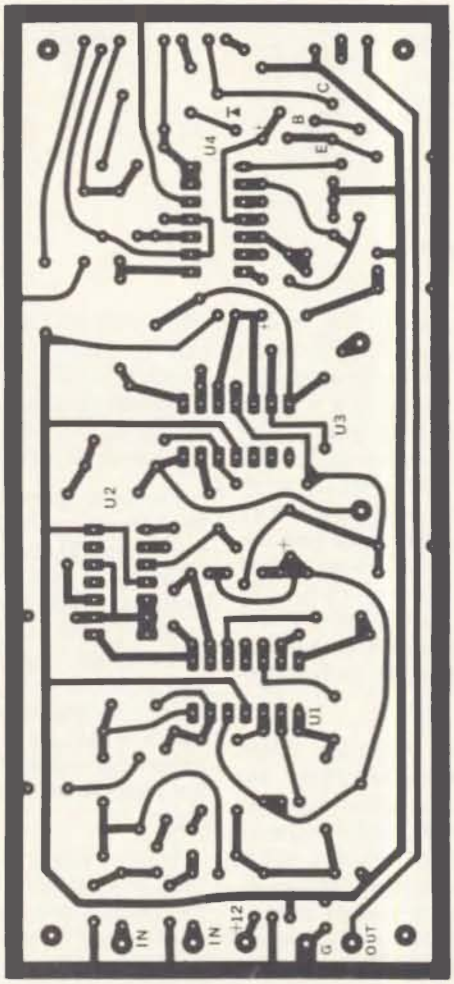

Fig. 2. PC board (foil side).

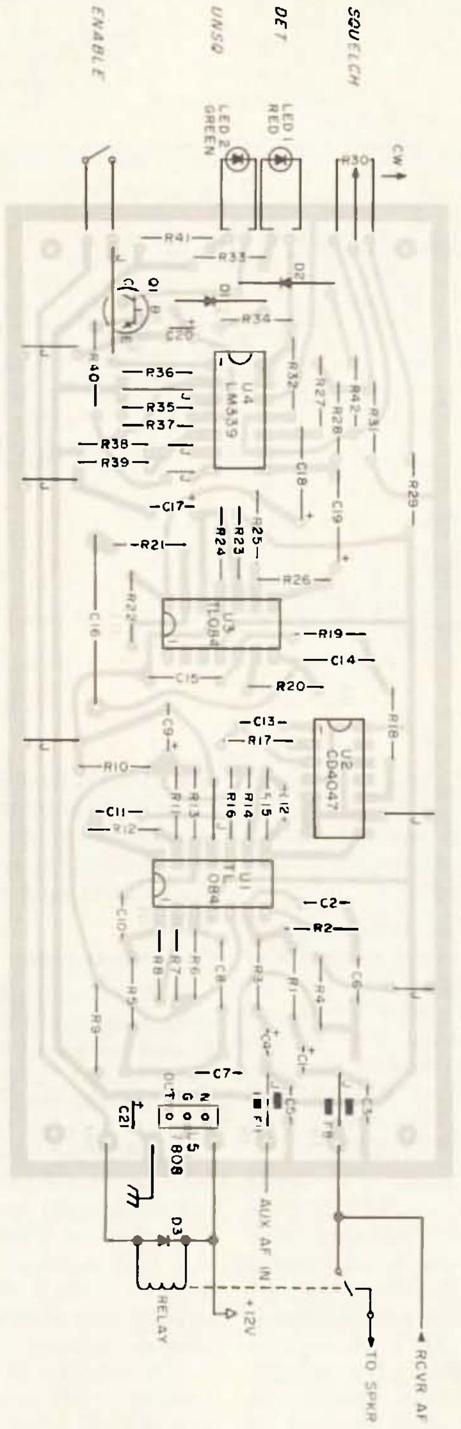

Fig. 3. Component layout.

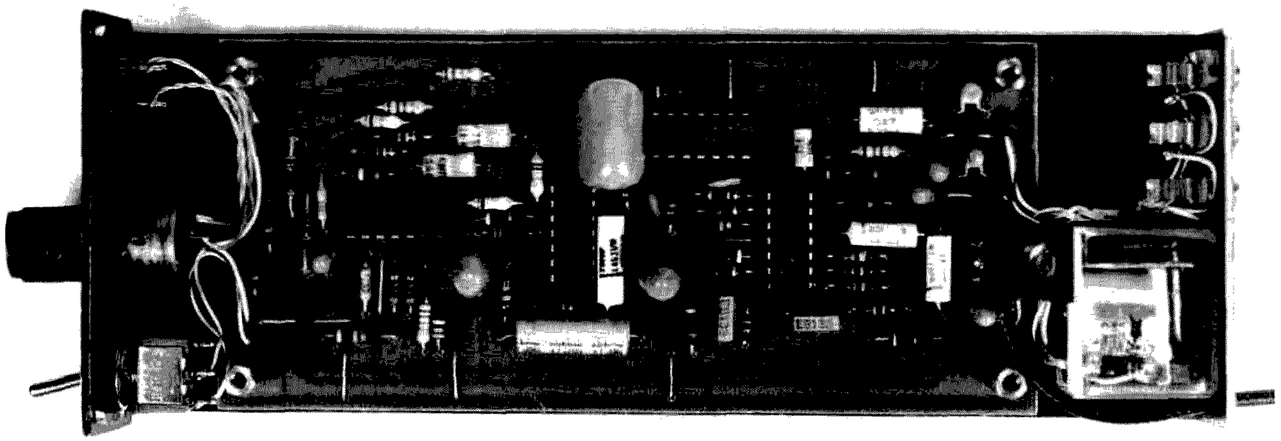

Photo B. Circuit board and chassis detail. The only external connections required are receiver audio, speaker, and 12 volts dc. (Photo by KA9FJS)

detect. Q1 conducts while squelch is open, further reducing the threshold voltage via R42 and D2. R42 determines the amount of hysteresis. The 100k value shown for R42 provides smooth squelch operation.

The circuit uses 25-30 mA plus relay current. The eight-volt-regulator IC, U5, should be used for mobile operation. Otherwise, the entire circuit can run from a well-regulated 12-volt supply. (Omit U5 and add a jumper between input and output pins of U5 on the PC board.)

Adjustment

LED1 lights whenever the detector is active. Listen to a voice signal and adjust the threshold control until LED1 blinks for every spoken syllable, then make fine adjustments as necessary for noise conditions. The *enable* switch allows you to adjust the squelch before activating the relay and allows you to unsquelch without disturbing the threshold setting. Scale markings around the control knob make it easier to reset an often-used level.

Construction

All-new parts cost about $40, using referenced items from Radio Shack and ECG. Resourceful hams can build

Parts List

Semiconductors

U1, U3	TL084C quad BIFET op amp	2	$ 5.98
U2	CD4047 CMOS multivibrator (ECG 4047)	1	1.49
U4	LM339 quad comparator	1	1.50
U5	7808 8-volt regulator (optional—see text)	1	.99
Q1	2N2222 or equiv. silicon NPN transistor	1	.15
D1, D2	1N914 or equiv. silicon diode	2	.20
D3	1N4002 or equiv. silicon diode	1	.10
LED1	Red LED (rectangular)	1	.49
LED2	Green LED (rectangular)	1	.49

Capacitors (All 20 V or more)

C12	68 pF	1	.12
C3, C5, C13	1000 pF	3	.45
C7, C8	4700 pF, 5%	2	.60
C6	0.047 uF, 5%	1	.30
C2	0.056 uF	1	.30
C10, C11	0.1 uF	2	.30
C15	0.22 uF, 5%	1	.40
C14	0.47 uF, 5%	1	.40
C1, C4, C20, C21	1 uF, electrolytic	4	1.60
C16	4.7 uF, non-polarized (RS 272-998)	1	.99
C18, C19	6 uF, electrolytic	2	2.36
C9, C17	47 uF, electrolytic	2	2.00

Resistors (All ¼ Watt; * = 5%)

R1, R2, R3, R33, R41	1k	5
R11, R14	2.7k	2
R9, R10, R23, R24	4.7k	4
R4*, R31	6.8k	2
R30	5k, linear pot	1
R13, R16, R34, R36	10k	4
R29	18k	1
R40	47k	1
R38	56k	1
R5*, R6*, R7, R8, R21	68k	5
R25, R26, R39, R42	100k	4
R22, R27, R28	130k	3
R18*, R19*	150k	2
R17	160k (see text)	1
R20	300k	1
R12, R15	360k	2
R35, R37	1M	2
R32	2.4M	1
	42 @ $.08 ea. = $3.28	

Other

Ferrite beads	2	.10
Miniature earphone jacks	3	1.29
Relay, 12-volt SPDT (RS 275-003)	1	2.99
Switch, miniature toggle SPST	1	1.49
Control knob	1	.49
Hardware, PC board, chassis		10.00
Parts Total		$40.85

the circuit for substantially less.

We built several prototypes on universal printed-circuit cards. The only critical area is U1, where high limiter-amplifier gain can cause feedback oscillation in some layouts. Keep component leads as short as possible. Use 5% tolerance or better for frequency-determining components in active filters. The Radio Shack relay's frame must be insulated from ground. Mounting the relay on a rubber pad quiets its clicking and isolates it from vibration.

Conclusion

Although squelch effectiveness may diminish on very crowded amateur bands, a sensitive, discriminating squelch is very useful for net operations and scheduled contacts, especially with modern digitally-tuned receivers which can be preset to precise frequencies.

This circuit can be a starting point for many experiments. You could, for example, insert an analog delay device between audio input and output. If the delay were longer than the squelch response time, then squelch would open *before* the first spoken syllable reaches the loudspeaker.

Digital techniques could perform the function of the analog circuit described here, perhaps with improvements such as adaptive threshold and program-controlled time constants. We are experimenting with a microprocessor-based voice detector which may be the subject of a future 73 article.■

References

[1]Don Lancaster, *Active Filter Cookbook*, Howard W. Sams & Co., Inc., 1975.
[2]Motorola *Micom* HF SSB Transceiver Service Manual, 1975.

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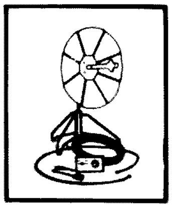

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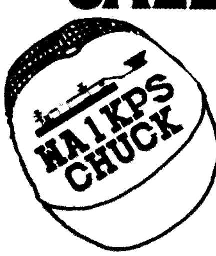

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Recently, while working on the design for a new power supply, I managed to blow over a dozen fuses. My regular ham buddy was on a weekend fishing trip, so I kept making the same, simple error. After the trouble was located and corrected, it somehow struck me: There's got to be a better way!

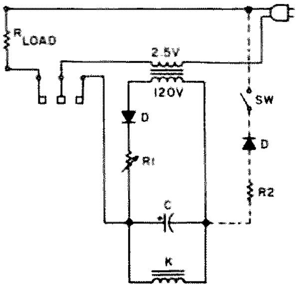

Fig. 1. The early circuity was fairly simple, but half-wave rectification from the 120-volt winding caused the setup to be less sensitive than desired. Added components shown connected with dotted lines are needed to keep the relay locked up after an overload has caused the circuit to be broken. (Note: Relay shown at rest, i.e., non-energized.)

In the past, hams who built their own power supplies could depend on manufacturers to offer several different types of relays, some with manual reset capabilities and some with electrical reset features, but such items are no longer available to the amateur builder. In view of this deficiency, a few years ago I offered a homely solution to the dc overload-relay problem: how to home-brew what you can no longer purchase.[1]

It is common practice for commercial and military installations to provide circuitry to protect their power supplies, both as to input and output. Dc overload relays are properly installed in the output of the rectifier or filter circuits, and ac overload relays are installed in the primary circuits of the various power supplies, and so on. But I had yet to see how an amateur experimenter might put together a suitable substitute for an ac overload relay.

In an earnest effort to devise some sort of simple circuitry for such a need, it came to mind that several factors had to be taken into consideration. The system had to be simple, foolproof, and, above all else, inexpensive. There is no logic in providing an expensive method for the sort of thing which a typical amateur might wish to protect. The setup to be described satisfies all of the foregoing.

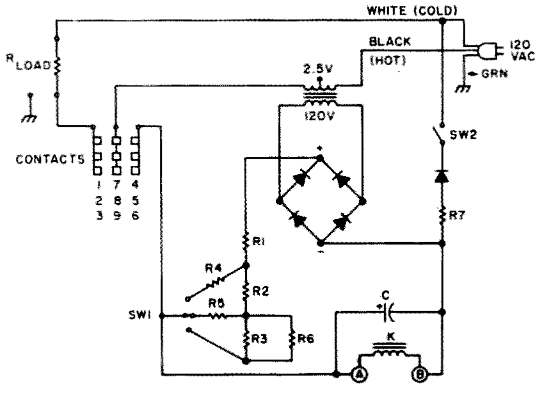

Fig. 2. Final version of overload relay. SW1 selects 2.5-, 5-, or 10-Amp kickout points.

The heart of the protective circuit lies in the utilization of a surplus 24-volt dc relay. These are widely available at low cost. If such a relay can be incorporated into a simple circuit, then we should end up with a satisfactory combination for taking care of ac overloads.

Refer to Fig. 1. Note that we have incorporated a surplus 2.5-volt filament transformer of 10-Ampere rating. Since silicon diodes came into play as substitutes for mercury-vapor tubes, such transformers have become a drug on the market. But a suitable transformer of similar ratings should serve; that is, a low-voltage secondary and rather high current rating.

Preliminary experiments

led me to develop the most elementary circuitry to fulfill the concept. When current is passed through the 2.5-volt winding a current will be induced into the 120-volt winding (now the secondary). After rectifying and filtering, the dc voltage is used to actuate the 24-volt dc relay. The variable resistor, R, can be adjusted to allow various ac currents to pass before the relay will trip and open the ac circuit.

This will not completely suffice, however, since the relay will buzz back and forth between on and off unless some form of lock-up is provided. The added components, shown by dotted lines, attend to this function. Lock-up is obtained with lower current than is required for pull-in, and simple half-wave rectification will serve. Reset is furnished by opening the switch, which is normally closed.

The system that finally evolved is shown in Fig. 2. The full-wave bridge rectifier furnished more voltage than the original half-wave circuit and allows the relay to trip out at a lower current. In a thorough search for a relay of better suitabilities, over a dozen relays were checked out experimentally. Finally, it was decided to opt for a relatively sensitive unit which has the added advantage of having three sets of contacts, all rated at 10 Amperes. To be on the safe side, these are wired in parallel.

My thoughts then were directed to the feasibility of obtaining a suitable variable resistor, in order to enable the relay to actuate at various current settings. Easier said than done!

The three principal calibrating resistors are used in place of a "nice to have" 3000-Ohm, 10-Watt wirewound potentiometer. The 5-Watt, 1000-Ohm size is a fairly common item in all stores which cater to radio and TV servicemen. Additional resistors were added to cause the setup to kick out at 2.5, 5, and 10 Amperes. This 4-to-1 range is in line with what the commercial makers of such relays—Westinghouse for example—design into their products.

Other design factors worth mentioning are:
(a) The 100-uF electrolytic capacitor seems to be about right in this setup. A lower value may cause the dc relay to buzz, and a higher value can cause a time delay to take place—definitely undesirable in any form of protective circuitry where high power is involved; and (b) Avoid carbon resistors in the 1000-Ohm positions. Careful checks show that a 1000-Ohm, 2-Watt carbon resistor will be dissipating 1.6 Watts or 80% of its full value. This will cause upward change in the resistance, and, indirectly, "calibration creep" in the finished instrument.

Random thoughts at this juncture: Others have asked me whether simpler devices, such as the thermal overload units commonly found on the back of TV sets, would suffice. These have been tried and their use cannot be justified since the time delay is intolerable where an expensive unit requires protection. Personally, I almost lost a very nice Powerstat® while attempting to live with such protection.

Perhaps solid-state devices might be designed to furnish the same function? I would be disinclined to depend upon such a setup in view of the relatively high-voltage spikes which are encountered when a highly inductive component—such as the power transformer in a large amateur rig—needs to have its primary circuit interrupted. For that reason, I chose 1000-volt silicon diodes, type 1N4007, for service in this unit.

So we have an ac overload relay which is simple, inexpensive, and dependable. Furthermore, it can be calibrated to kick out at several different amperages at the flick of a switch. I have yet to see such a simple item described in print, and I thought it would be nice to share this knowledge with other members of the amateur fraternity. So, why not try this out and experiment at ease, without blowing box after box of fuses?

All of the foregoing calibrations were obtained with ac loads consisting of non-inductive heater coils. If your circuit to be protected is highly reactive, you may find the relay kickout points to be slightly different. ■

Parts List

T— 2.5-volt, 10-A filament transformer
D— all diodes type 1N4007
C— 100 µF, 35 volts
S1— Rotary switch with 3 positions
S2— Momentary-contact switch, wired for normally-closed operation (Radio Shack 275-619)
K— Potter & Brumfield type KUP 14D15 (Fair Radio Sales, Lima, Ohio, $2.50)
R1-R3—1000 Ohms, 5-Watt, wirewound
R4, R5—330 Ohms, 1-Watt
R6— 15k Ohms, 1-Watt
R7— 2700 Ohms, 2-Watt
Small cabinet or chassis, 3-wire ac cord, and 5-way output terminals

Reference

1. "Son of the Overload Relay," *73 Magazine*, January, 1977, p. 140.

RF ANNOUNCING

RF PRODUCTS announces production of 5/8 wavelength VHF telescoping antennas for 144-148 MHz (2M), 152-174 MHz and 220-225 MHz (1¼M). These new antennas are intended for use on hand-held and base station transceivers. They are available with BNC connector, 5/16-32 stud, or PL-259 connector. A telescoping brass nickel-plated nine section radiator is used for lighter weight and less RF junctions than previously available 5/8 wavelength antennas. Maximum gain is acheived by the combination of a base spring for whip protection and a tuned matching network for minimum VSWR. Minimum 2-meter bandwidth for 1.5:1 VSWR is 3.5 MHz. Overall length with BNC connector is 45¾ inches (1162mm). The BNC connector and 5/16-32 stud models are intended for hand-held transceiver (HTs) use and the PL-259 model which includes a type M359 right angle adaptor is intended for direct rear mounting on base station transceivers. Suggested list price for all models is $19.95 the most popular of which are listed below.

P/N	DESCRIPTION	P/N	DESCRIPTION
191-200	2 M, 5/16-32 stud	191-800	1¼ M, 5/16-32 stud
191-214	2 M, BNC connector	191-814	1¼ M, BNC connector
191-219	2 M, PL-259 connector	191-819	1¼ M, PL-259 connector

ELECTRICAL SPECIFICATIONS		MECHANICAL SPECIFICATIONS (With BNC)	
Gain(ref. ¼ wave helical)	6db min.	Length extended(2M)	45 3/4"/1162mm
Bandwidth(2M), 1.5:1 VSWR	3.5MHz min.	Length extended(1¼M)	32 1/8"/815mm
Bandwidth(1¼M), 1.5:1 VSWR	5MHz min.	Length collasped(2M)	8 1/16"/207mm
Maximum power(HT models)	10 watts	Length collasped(1¼M)	7 7/8"/200mm
Maximum power(PL-259 model)	30 watts	Weight	2.2oz/60g

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Multi-Purpose Peak Adapter

—don't settle for being average

This adapter was originally designed to be used with a Bird 43 wattmeter, using the standard plug-in elements; however, this same unit can be modified for use with almost any rf detector or swr bridge. Circuits can be easily added to provide an adjustable peak output indicator and/or an alc output for transmitter control. The peak adapter circuit also can be used with an FM receiver as a peak-deviation meter. Easily-obtainable parts are used and while I built mine in a separate box, you might be able to build it into your meter enclosure. The ICs must be kept away from high rf levels, however. The peak adapter circuit is shown in Fig. 1.

The unit must be powered from a bipolar supply of ±6 to ±15 volts or from a pair of 9-volt batteries. If extended use of the adapter is anticipated, the ac supply shown in Fig. 2 should be used. Regulation is not totally necessary, but does ensure minimum offsets and prevents transients from entering critical circuits.

The main purpose of the peak detector circuit is to overcome the main fault of a meter when trying to indicate peaks: the mass of the movement damps the response time such that variations of the applied current are *averaged* out. The more sensitive the movement, the worse the damping effect. The Bird 43 uses a 30-μA movement and most swr bridges use a 50- to 200-μA meter.

Even with the peak detector, the meter will still

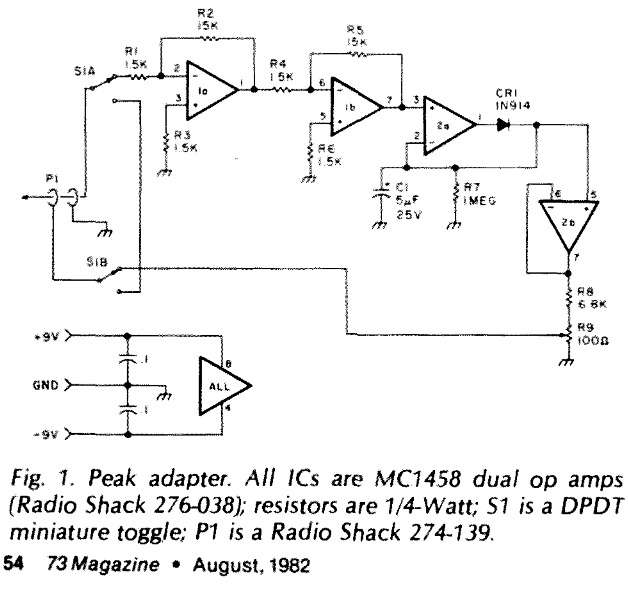

Fig. 1. Peak adapter. All ICs are MC1458 dual op amps (Radio Shack 276-038); resistors are 1/4-Watt; S1 is a DPDT miniature toggle; P1 is a Radio Shack 274-139.

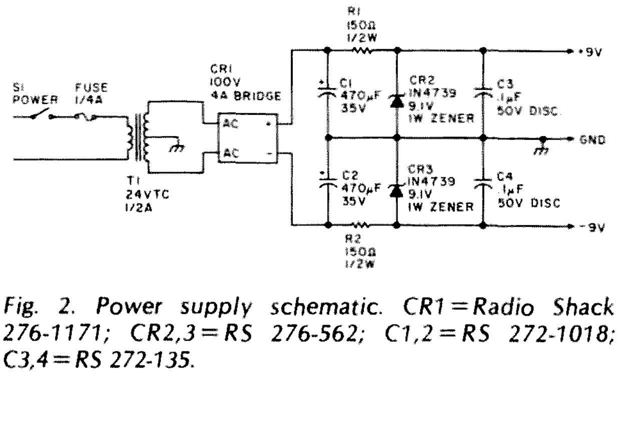

Fig. 2. Power supply schematic. CR1 = Radio Shack 276-1171; CR2,3 = RS 276-562; C1,2 = RS 272-1018; C3,4 = RS 272-135.

take the same amount of time to respond to its highest level, but the circuit has a long enough time constant to ensure that the pointer will remain at the peak level long enough to be observed. The Bird 43 elements contain a half-wave detector (+ output) and a small capacitor to bypass the rf. Internal resistance of the 30-μA meter is 1500 Ohms, so to ensure proper linearity, the input of the peak adapter presents a 1500-Ohm load to the element.

Circuit Description

The first two stages are standard inverting dc amplifiers. Each stage has a gain of 10 for a total of 100. Thus, a full-scale input level of 45 mV results in an output of 4.5 V dc. IC2A is a unity-gain half-wave detector. The diode's placement in the feedback loop eliminates the error due to its 600-mV drop. The input impedance of IC2A is high, so the discharge time constant is essentially determined by R7. The output impedance of IC2A is less than 100 Ohms, so the charge time of C1 is almost instantaneous. IC2B is a unity-gain follower configuration used to isolate the load from C1. Amplifying the input signal by 100 ensures overcoming any low-level non-linearity in CR1. R8 and R9 divide the output back down to a level required to feed the meter.

Fig. 3(a) shows the original circuit in the Bird 43. The meter connects directly to the output of the directional coupler through a length of coax cable. The length is not critical and is supplied as a convenience to permit remote mounting of the directional coupler.

Fig. 3(b) shows the jack added to the Bird meter to permit connecting the peak adapter. I mounted the jack on the right side of the case. (Remove the meter movement before drilling the 3/8" hole!) The jack is a 3-conductor, ¼"-type with shorting contacts (Radio Shack part number 274-139). The shorting contacts connect the meter to the coupler when the remote plug is removed, so no switch is necessary. Use the "ring" connection for the meter and the "tip" for the coupler output. Break the connection at the positive lug of the meter. Even though the jack is grounded to the case, it is a good idea to run a wire from the negative meter terminal to the "sleeve" connection of the jack.

Calibration is easily accomplished by connecting the meter between the transmitter and a 50-Ohm load. Measure the power output with a steady carrier (preferably at least half-scale). Switch on the peak detector circuit and adjust R9 for a reading of 1.4 times the first reading. The meter now is calibrated to read peak power output (with a load impedance of 50 Ohms).

PEP output is defined as the peak-to-peak level of the output signal. It is not practical to have the meter read this since it would be necessary to change to the next higher element. R9 could be adjusted so the PEP would be read on the next higher scale using the same element; however, damage to the element could occur since it would be used outside its normal range.

When observing a voice-produced SSB signal, you will have to talk for several seconds to allow time for the meter movement to respond. A longer "hang" time can be obtained by increasing the value of C1.

The output of an swr bridge is similar to the Bird elements but the load impedance is usually higher. To use the peak detector with an swr bridge, or a

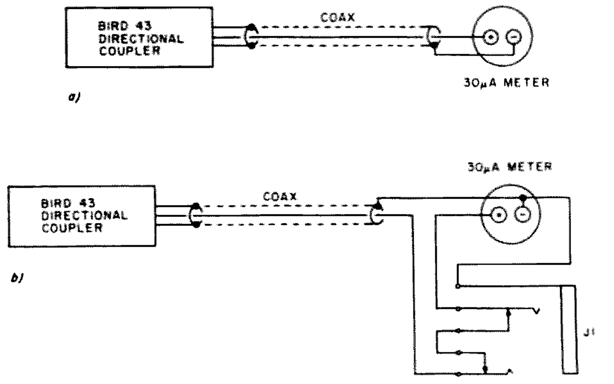

Fig. 3. (a) Original Bird 43 hookup. (b) Modified hookup using Radio Shack 274-277 for J1.

detector like the one in the Heath Cantenna®, change the circuit of IC1A to that shown in Fig. 4. You will have to calibrate the meter at several different power levels. The dc output voltage of a bridge detector, and the detector in the Cantenna, drops with a decrease in frequency, so calibration at several frequencies in each band is desired. Calibration must be done with the aid of a borrowed wattmeter, an rf ammeter or voltmeter, or a wideband scope that has a vertical amplifier response flat to at least 30 MHz.

When using the peak adapter with a device like the Cantenna, you will have to furnish a meter for the adapter. Any movement up to 5 mA can be used or a VOM on the 2.5- or 3-volt dc range. Just be sure that the VOM you use will not detect rf by itself. If you use a 1-mA meter, you can eliminate R9 and use a 3.9k resistor for R8. Calibration can be done with R19. A typical swr bridge circuit is shown in Fig. 5.

At a power of 100 Watts rms into the Cantenna, I obtained the following read-

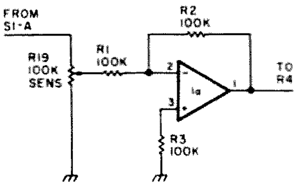

Fig. 4. High-impedance peak adapter.

ings from the Cantenna's detector:

Band	Dc Volts
160	0.8
80	1.0
40	1.4
20	2.0
15	2.5
10	3.0

The circuit of Fig. 6 is a peak-indicator driver with adjustable threshold control. R10 is adjusted with a steady carrier to light the LED at the desired power level.

Alc voltage can be applied to most mixers or intermediate stages in a transmitter to reduce the rf level before the output stage is driven into the non-linear region. The alc voltage can be developed by adding the circuit in Fig. 7. It even can be useful for transmitters that already have alc because gain reduction can be

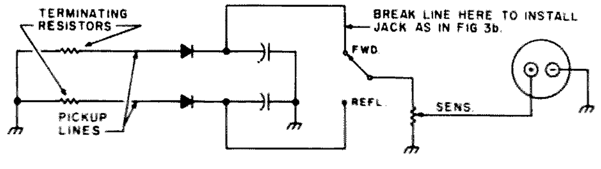

Fig. 5. Typical swr bridge.

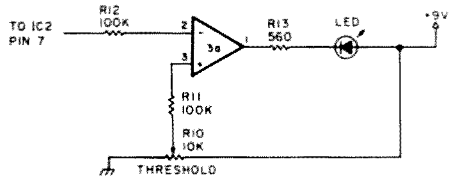

Fig. 6. Visual peak indicator.

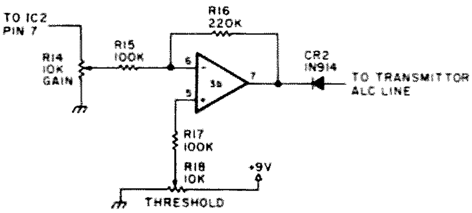

Fig. 7. Alc detector.

had at a lower level. (Many transmitters develop alc voltage when grid current is drawn, at which point distortion is already occurring.) With R18 at the ground end, alc will be developed as soon as there is rf input. R14 determines the amount of voltage output. Increasing R18 towards +V permits a higher rf level before alc starts to develop. CR2 keeps any positive voltage from reaching the alc line.

Both the circuits of Fig. 6 and 7 can be connected to IC2 simultaneously without any interaction. Again, change the value of C1 if you wish to change the time constant. Most likely, you will want to reduce C1 to 0.2 to 0.5 μF for alc purposes. A switch may be added to Fig. 1 to select various values for C1.

Another use for the peak detector circuit is to use it in conjunction with an FM receiver as a peak-deviation meter. Using the Fig. 4 modification, connect R19 to the output of the discriminator through a 0.1-μF capacitor. Calibration can be done best using a signal generator with calibrated FM modulation. If C1 is switched out of the circuit, the meter will then read average deviation. This may be useful to show how much the transmitted audio is limited in the peak clipper. In any case, the readings will only be correct if the received signal is full quieting. A scope may be connected to the output of IC1B for viewing the audio signal.

If you have looked at the proposed rewrite of the amateur rules, you noticed that the FCC is trying to come up with a different way to determine transmitter power, other than the present dc-input method. This peak adapter can be an invaluable aid, should power determination need to be in terms of peak power. Personally, I would like the rules to be changed to power output measurements, as is done commercially. This could then permit less efficient transmitters to run at a higher input power. We also would have a better idea of the efficiency of our equipment which would indicate when the finals are getting "soft."

This circuit can make your wattmeter into a more useful instrument at a fraction of the cost of a ready-made peak-reading unit and serve other purposes as well. ■

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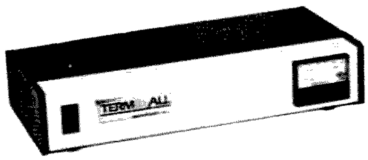

System Requirements

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Dwight "Rex" Rexroad with his Cheap Trick receiver.

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"See first run movies, sporting events, and nightclub acts as secret network feeds!" That's the sort of ballyhoo you read about satellite television nowadays. But the price for even a kit setup can run sky high! The only way to cut the cost is for you to do it all yourself.

But those build-it-yourself pitfalls can leave you wishing you'd never tried. For one thing, you're on your own with only plans that are vague or, even worse, a set of PC boards that won't work. So, being first on your block seems to carry its own set of problems. What you need is a "Cheap Trick"!

In the December, 1981, "Satellite Central," I wrote a brief overview of TVRO receiver design. If you priced some of the components, you know that a receiver, especially a dual-conversion job, will cost $500 to $700 to build. And, if you want real quality you'd better plan on spending more. So how can something any good cost less? As a matter of fact, just a voltage-tuned oscillator (VTO) runs a hundred bucks! So who's kidding whom?

But hold on there. Just when you think it isn't possible, along comes a very clever engineer like Dwight (Rex) Rexroad who does it with a flair that shows that hobbyist thinking and ingenuity hasn't stagnated after all. "The secret here," says Rex, "is to make the design non-critical and to use parts that anyone can find with ease. Nothing in this design is weird. Everything is off

the shelf." Out of Rex's unique approach comes "Cheap Trick," the ham's answer to a TVRO receiver you can build for under $100!

Cheaper Is Better

Look at the diagram in Fig. 1(a); Rex downconverts all twelve transponders on a satellite (3.7 to 4.2 GHz) to the 500- to 1000-MHz region where he can use cheaper components. He uses a fixed-frequency local oscillator (LO), a mixer, and a broadband amplifier, all of which may be mounted at the dish in a small box. The advantage to this arrangement is that the lower-frequency signals can be passed into your house via RG-59 or RG-6 rather than expensive cable needed for piping 4-GHz signals.

No tuning is done in the first conversion—see Fig. 1(b). Instead, tuning is applied at the second conversion by another cheap trick, a UHF TV tuner. The saving is enormous, especially since the tuner needs very few changes to make it pass 30-MHz-wide signals to a 70-MHz bandpass filter and intermediate frequency (i-f) amplifier. Despite its reduced performance at 70 MHz, Rex uses a typical TV i-f IC, the MC1350. It's a logical choice for the i-f amplifier because of its low price and easy availability. Razor-sharp tuning is easily accomplished using just two op amps with a solid afc thrown in to boot.

The amplified 70-MHz i-f signals are halved to 30 MHz by a divide-by-two circuit and applied to an MC1357 quadrature detector IC which, with suitable input, can deliver pictures that may exceed in excellence those of a PLL-type detector. The detected video is clamped and de-emphasized before output to your TV monitor or modulator. The sound demodulator uses circuitry similar to that found in most television sets.

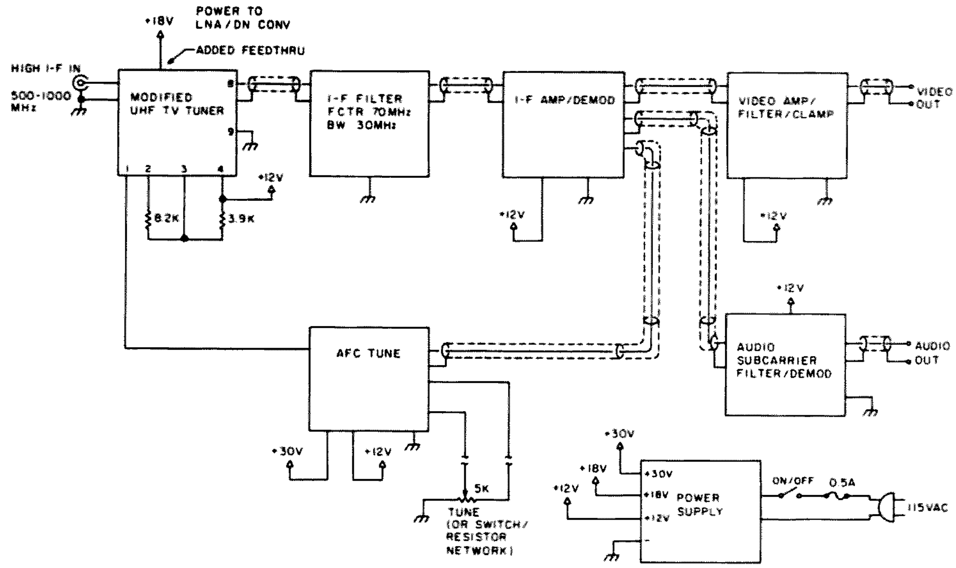


Fig. 1(a). Block diagram of the Cheap Trick receiver.

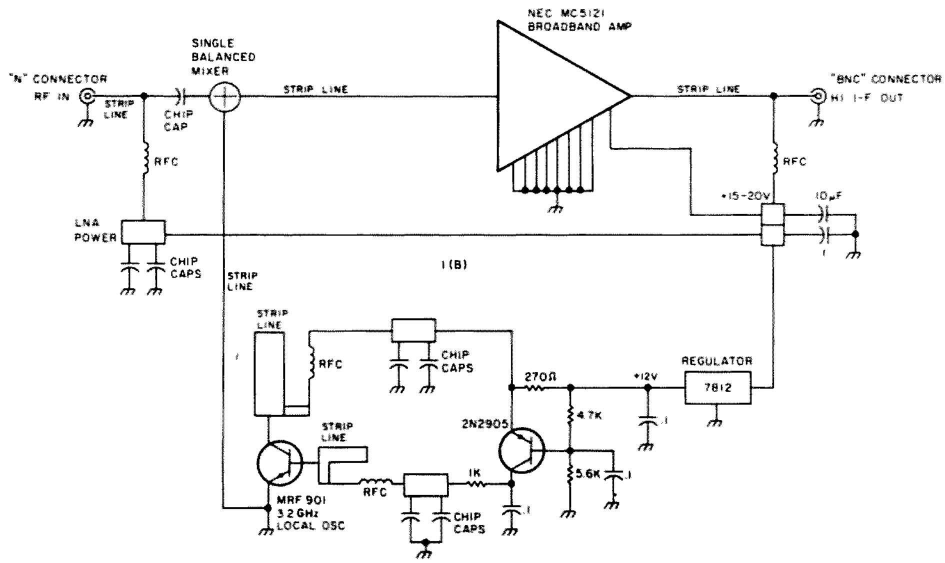


Fig. 1(b). First stage of the receiver downconverter, including balanced mixer and local oscillator.

Power Supply and Downconverter

This month, we'll delve into the power supply and clever downconverter design and save the baseband circuits for next month. It should be remembered that this project is labor-intensive. If you just want to watch satellite television, then you really should buy a receiver rather than fiddle with the "Cheap Trick." Some of the techniques used here will surely challenge your experimenting abilities.

According to Rex, "The power supply is not quite typical . . . but close. I use a 26-volt, 1-Ampere transformer that is center-tapped. This is a common transformer. Radio Shack has them. [Rex needed 30 volts for tuning and took the easy way with an LM317 adjustable voltage regulator—see Fig. 2.] I found that bypassing the LM317 got rid of a lot of noise, especially since we are dealing with the tuning voltage where noise could easily FM your tuner! It's clean as a whistle."

The really clever technique used here is to raise the centertap to get about half the voltage (18 volts) to feed the LNA-downconverter combination. A 7812 regulates it down to 12 volts to feed the rest of the receiver. While Rex admits this is not an optimum design bal-

ance-wise, it offers something more important: It's cheap!

Looking now at the downconverter in Fig. 3, Rex built the whole unit on a piece of double-sided 1/32" Teflon™ fiberglass. In true one-of-a-kind experimenter fashion, he used only an X-acto® knife to cut out the prototype. You can, too. The board is only 4 inches long, so the input and output connectors are all that are needed to attach the board to the top of a sealed metal case.

The circuit includes a dc block so that both the downconverter and the LNA can receive their supply voltage through the signal coax. Beginning at the input, Rex uses a type-N connector since that's about the only thing that works well at these frequencies. An rf choke . . . which is nothing more than a short piece of wire at 4 GHz, feeds dc to the LNA.

"We do a little bypassing with two chip caps—a 4.7-pF and a .001-mF work pretty well at these frequencies. I bypass darned near everything because stability is very important. Especially when you home brew," he says.

"I used a fixed-tuned MRF-901 for the oscillator so that I could save big bucks right there! The real credit for this stable design belongs to BBC engineer Steve Birkill. The oscillator runs at 3.2 GHz (downside injection) and is easily set by trimming the length of the baseline with a knife.

"I used a 7812 voltage regulator, but a 78L12 would also work since we need only about 15 mA. The 2N2905 is a PNP transistor that acts as an active bias for the oscillator. It's the negative feedback loop that makes this trick work. In fact, it may be more stable than expensive prepackaged oscillators if you use good construction technique. And don't think you're locked into a 2N2905. Any other silicon PNP of the same beta should work just as well."

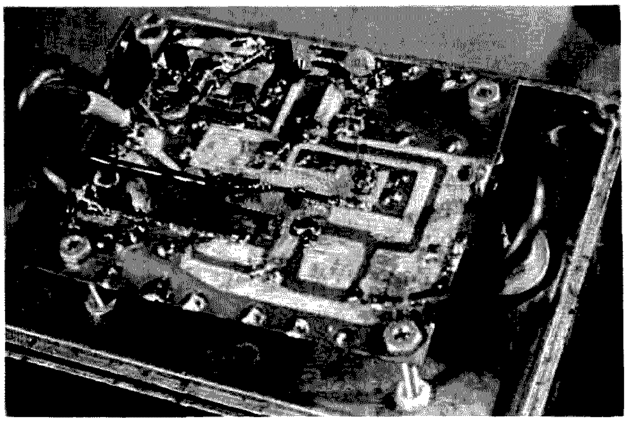
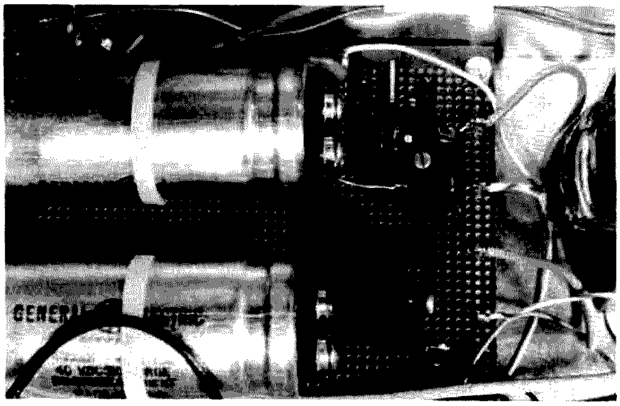


Fig. 3. The mixer, MRF-901 oscillator, and broadband amplifier fit on a homemade PC board.



The oscillator will come out low in frequency using the layout size in Fig. 4. That way, you can simply use a knife to chop away enough trace to put it right on. The line from the oscillator is a 50-Ohm stripline. Both the oscillator and input signal feed a balanced stripline mixer which has about 7-dB insertion loss depending on the diodes. Now, rather than use a $55.00 mixer, Rex literally chose to roll his own. He uses HN-1 diodes at about $2.00 each. Quite a saving! It really doesn't matter how you install the diodes; just be sure they are backwards or you'll have a problem. If you use the popular MBD-101 diodes, you may have to deal with slightly more noise out of the mixer. This may not be a problem if you use a large dish and a commercial LNA.

The NEC MC5121 broadband amp is the most expensive part of the whole receiver. It costs about $13.30 from Alaska Microwave, a *73* advertiser. Kick in another 25 cents and you can get the spec sheets, too. The MC5121 will give you about 20-dB gain, so the overall converter gain is about 14 dB not counting coax losses. Either a BNC or type-F connector will work on the output since the signal is now running somewhere between 500 and 1000 MHz. On a typical system, you can tolerate about 15-dB loss from the coax feeding the baseband unit. The +15 to +20 volts of power for the converter is tapped off the output coax with a 6-turn choke and some dc bypassing. There is no coupling capacitor on the MC5121 since it has its own internal caps.

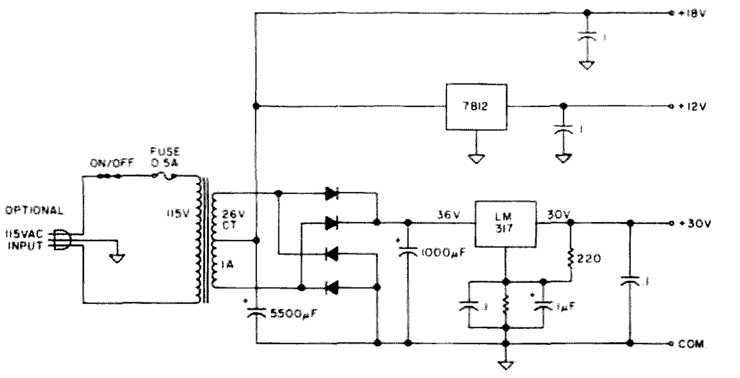


Fig. 2. The power supply furnishes +30, +18, and +12 volts dc.

Making It Work

Probably the hardest part of this project will be acquiring the parts. Yes, you *can* do it for less than $100. In fact, Rex built his for $75.00!

Dropping down in the scale of hardness, we come to troubleshooting. According to Rex: "A spectrum analyzer helps. Use a micro-

wave frequency counter attached to the hybrid to tune the LO. Not everyone has one, so I suggest you simply apply power to the unit and tweak the oscillator until the bottom frequency corresponds to transponder one. You'll need a dish and an LNA that are working to do it.

"One thing that's nice: Being off 100 MHz in either direction will get you in the ball park enough to trim it up. Of course, having a friend with another TVRO always helps."

It is possible that the LO will not be stable or, worse, may not start at all. In that event, Rex suggests you move the shorting strip seen in Fig. 5. Do a tack-solder job. You may find a region where the oscillator is operating on many frequencies at once. It makes for rotten pictures, so move the shorting strip to cure the problem. Trial and error are the only ways to do the trimming without an analyzer.

New Life for UHF Tuners

Once the signal is converted to the 500-to-1000-MHz range, it is fed down the coax into the UHF tuner. Use top-notch RG-59 or better. No CB stuff. Rex used a Mitsumi UES-A55F which he bought at a swap meet for five bucks. See Fig. 7. Various mail-order houses carry this model for something like $25.00. If you do some scrounging for other parts used in this project, you still can build Cheap Trick for less than $100.

Now, most tuners have a narrow bandwidth. So you must modify yours to pass 30-MHz-wide FM. Not all tuners can be modified, so you should try to track down this particular model. On the other hand, if you've stayed with us this far, you can probably handle anything that comes your way!

As a rule, the i-f output stage is the culprit. See the "before" and "after" modification circuits in Figs. 8(a) and 8(b). According to Rex, "I replaced the final stage impedance-matching network with a broadband transformer wound on a ferrite bead. Amidon 101-43 beads work pretty well. I used them everywhere in the project."

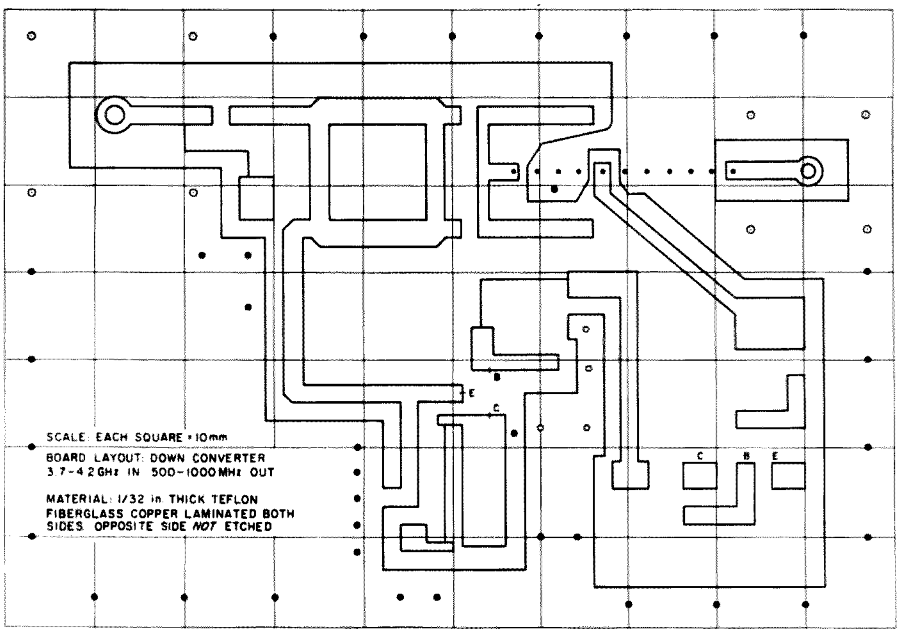


Fig. 4. Circuit board layout for downconverter.

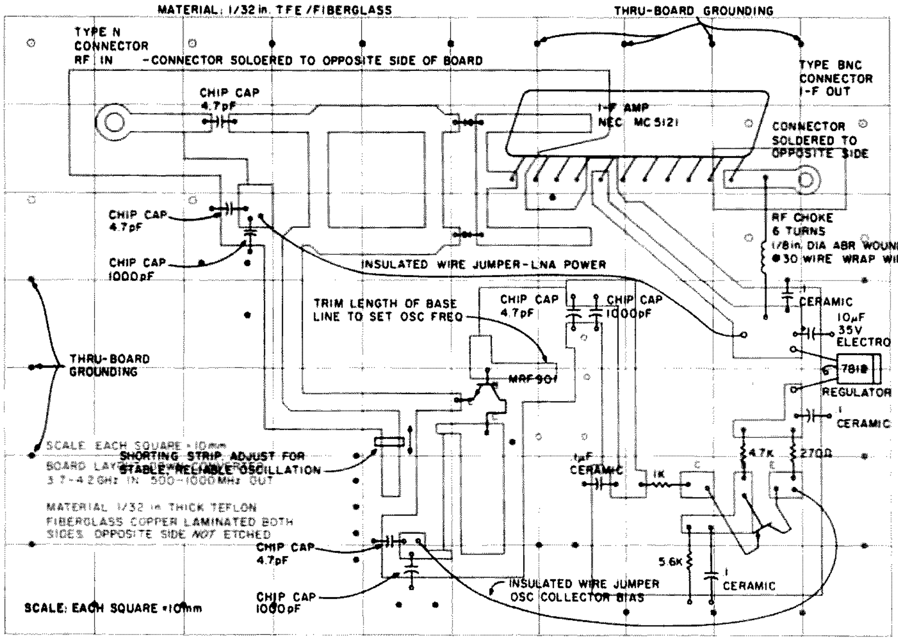


Fig. 5. Parts placement for downconverter.

The input stage should also be modified for a coax input. Some models of the Mitsumi already have a 75-Ohm input. "But if you were stuck with a 300-Ohm model," says Rex, "just look for the place on the board called L1 which was designed for a 75-Ohm link. You can couple to it with a little ceramic capacitor so you can use a 6-turn choke to provide a dc block to feed the coax power for the downconverter and LNA. You'll need to drill a hole in the tuner for this feed. I used a feedthrough cap so that I'd have a place to hook it.

"After these two mods, the bandwidth of the tuner should be about 45 MHz, and it will just cover the

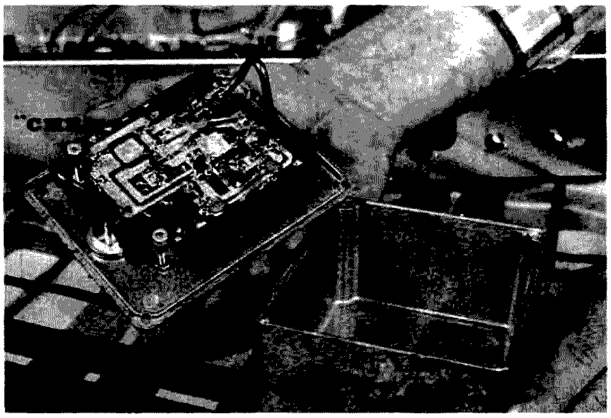


Fig. 6. The completed downconverter is housed in a watertight box. The PC board is held in place by the input and output connectors. A heavy dose of rubber cement will make a good seal.

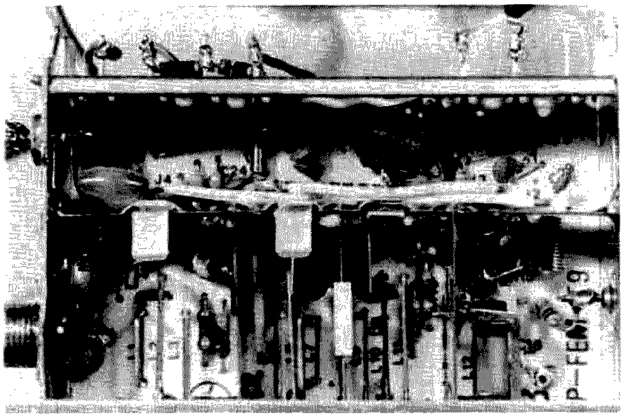


Fig. 7. A Mitsumi UES-A55F UHF tuner acts as the second converter with only two mods. The i-f output coil is replaced with a hand-wound toroid. Also, the input matching network is easily converted for 75-Ohm input. Mount the tuner inside the receiver chassis.

tuning range of all the input signals (500 MHz) with a little to spare. Here is where you must tweak the LO in the downconverter so that you get all transponders over the range of the UHF tuner. It's harder to say it than do it, despite the fact the tuning diodes don't give you much more than the needed 500-MHz range."

Rex suggests, "If you just drop one transponder, then diddle the tuner coils. But if you drop two transponders, you'll need to trot out to the LO/downconverter at the dish. You may have a fellow ham with a frequency counter in this range which should make the whole process very simple."

The tuner agc bias should be about 8 volts. The resistors seen in Fig. 1 form a suitable voltage divider. Eight volts is maximum gain.

Next Month: Part Two

After the tuner comes baseband processing, which I'll cover next month. Rex uses some clever ideas to make this last part of the project look easy. In the meantime, start hunting for parts. ■

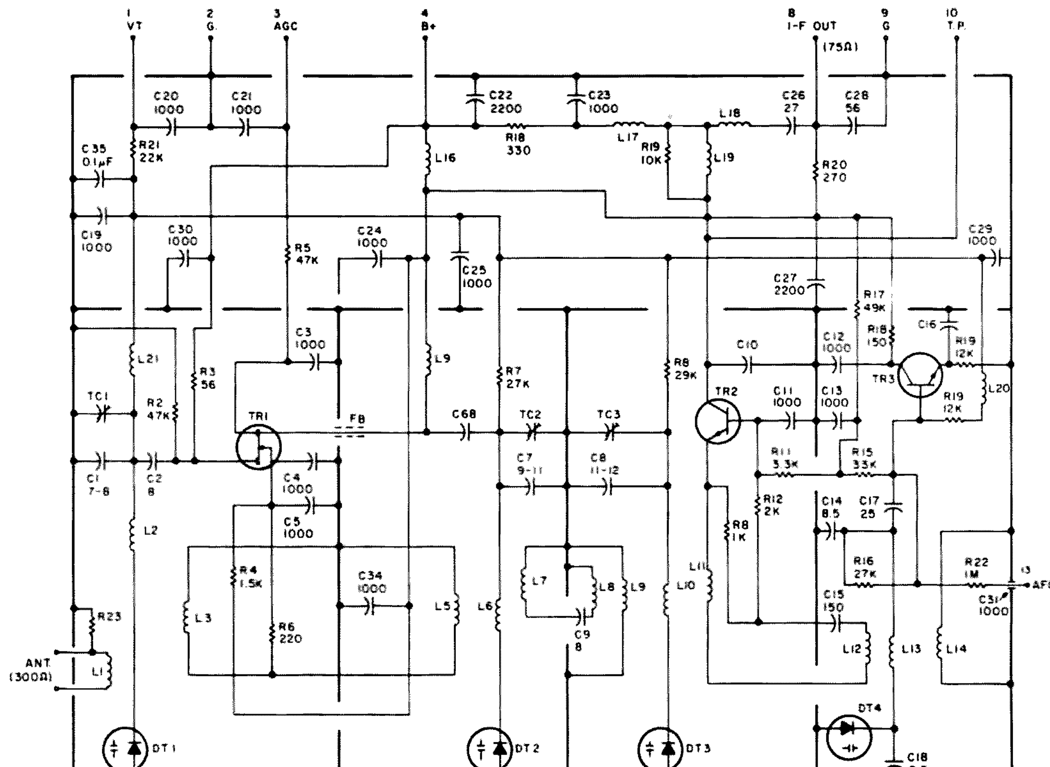


Fig. 8(a). Mitsumi VES-A55F tuner prior to modification. (1) Receiving channels—14-83 ch. (470-890 MHz). (2) P.I.F.—45.75 MHz; S.I.F.—41.25 MHz. (3) Supply voltage: BT—12 V; AFC—6.8 V; AGC—0.8 V; VT—0.5-28 V. (4) TR1—3SK53; TR2—2SC1070; TR3—2SC1730; DT1-DT4—1SV59. All capacitance values in pF; all resistance values in Ohms.

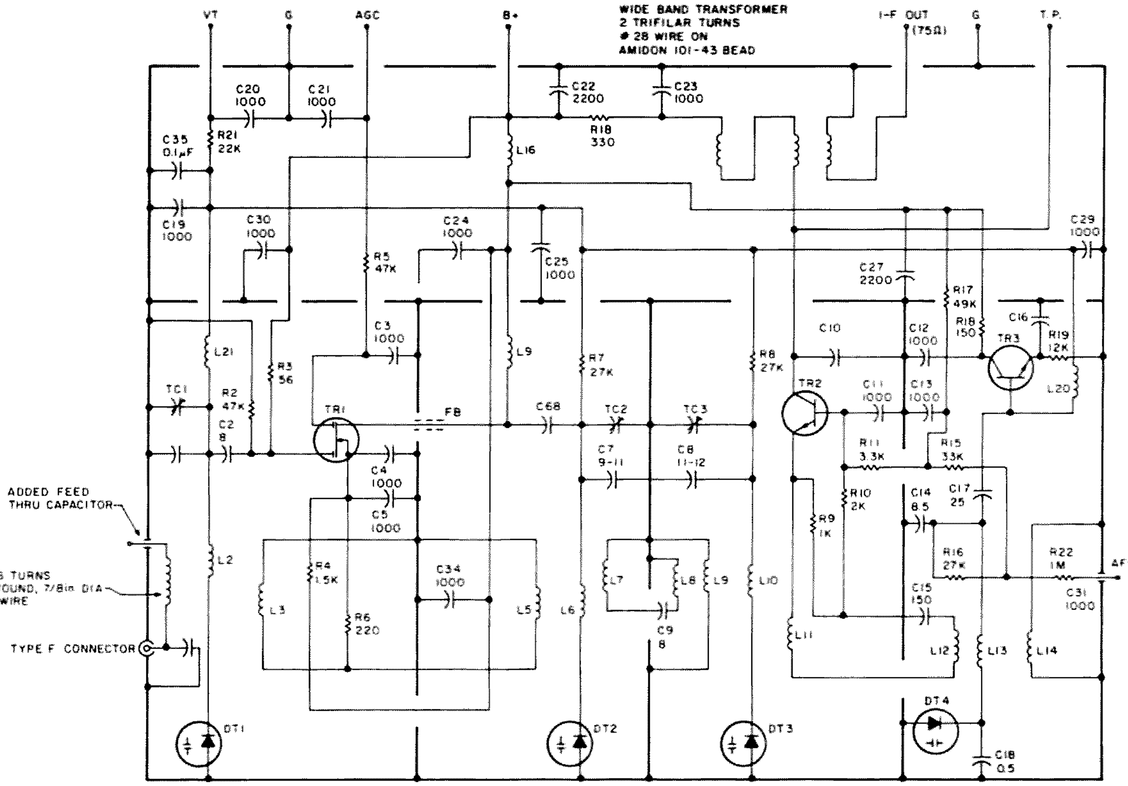
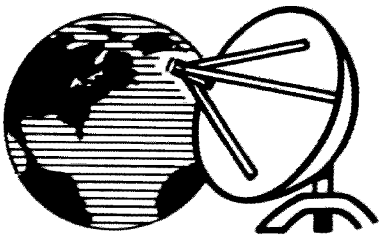


Fig. 8(b). Tuner after modification.



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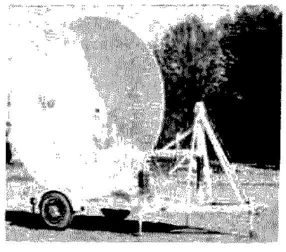

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VUM: Volume Units Meter

—makes measuring decibels easy

Have you ever wondered if the audio filter in your CW receiver is really as sharp as it is supposed to be? What's the frequency response of your stereo amplifier? How much insertion loss do you get when you stick that audio filter into that line? What's the trouble in that malfunctioning audio amplifier?

If you're a good troubleshooter, you can answer most of those questions with a scope, an audio oscillator, a VOM, and a calculator, but you can't do it either quickly or easily.

But a handy little device has been sitting on my bench for years which provides the answers quickly and accurately. It gets almost as much use as the VOM and a lot more use than the grid-dipper, and it costs very little to build.

Let's call it, affectionately, the V-U-M, for lack of a fancier term. Some electronics manufacturers make similar instruments which they call a "gain meter," and they have a very fancy price.

Basically, the VUM is an audio amplifier which has a calibrated step attenuator on the input and an audio voltmeter calibrated in decibels on the output. The meter itself is commonly seen on audio equipment of all kinds, such as good-quality tape decks, audio consoles, and such, and it goes by the name of "VU meter."

That's because it was originally devised for the broadcast industry to monitor "volume units" of complex voice and music waveforms so that audio input to an AM transmitter could be held within reasonable limits by the audio engineer "riding gain" on the program. In that sort of situation, one "volume unit" only approximates one decibel. But when sine waves are used, as they are in virtually all applications of the VUM, one VU exactly equals one dB.

These meters often can be picked up on the amateur market or at hamfests for a buck or two. They're available from most parts houses for anywhere from $6 to as much as $125, depending on how big they are and how fancy they get. Mine was rescued from a lightning-damaged Heath phone patch.

When using the VUM to solve bench or design problems, it is important to understand something about that interesting little animal, the decibel. It is a unit of measurement of power, voltage, or current, but you can't stick a VUM probe into an amplifier and say, "Ah-ha! It reads one dB!" That's like spotting a hitchhiker on the road and exclaiming, "Ah-ha! He's gone about halfway!"

Halfway from where to where?

A decibel is a measure of comparison. It is a ratio. It is used to state the difference between one level of energy and another.

It is also a rather com-

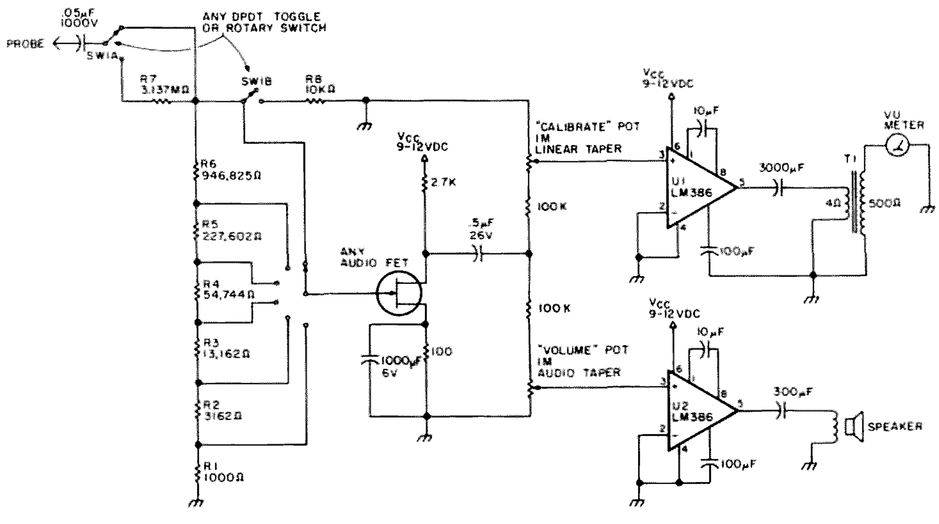


Fig. 1. The VUM (volume units meter), or calibrated audio dB meter.

plex little animal. It is not linear; it is exponential in nature. If you increase your transmitter output from 10 Watts to 20 Watts, the difference is 3 dB. If you increase it again, from 20 Watts to 40, the difference is again 3 dB. Ten Watts to 40 Watts is 6 dB, or two 3-dB steps.

If you increase line *voltage* from 120 volts to 240 volts, however, the increase is 6 dB. The basic formula for determining the dB difference between two *voltages* or between two currents is: dB = 20 log V2/V1.

Now, let's have another look at the VUM, this time in a little more detail. It is a convenient package of several different units:

- A voltage divider resistor string in which each tap on the divider provides 10 dB less signal than the one above it.
- An audio amplifier whose input is taken from the taps on the voltage divider and which drives the VU meter.
- A separate audio amplifier to let you hear what you're measuring.

Additionally, you will need a variable-frequency audio oscillator with adjustable output level. This easily can be built into the VUM as an integral part of the same package if you don't already have such an oscillator. It can be a fairly simple oscillator, covering the range from, say, 50 Hz to 20 kHz, built with ICs. But there are plenty of construction articles about these units and I won't get into that project here.

Essentially, the audio oscillator provides a tone of measurable strength and approximately-known frequency and the VUM measures what happens to that tone as it passes through amplifiers, filters, attenuators, and other exotic devices used by hams and audiophiles.

In my VUM (Fig. 1), the audio amplifiers are LM386 IC chips (available from Radio Shack for about one dollar each), which put out a potent little 400 mW and have a very wide frequency response, from well below the audible range, well into the superaudible. Other amplifier chips such as the LM2277, LM1877, or LM377 also can be used. They provide two 2-Watt amplifiers in the same chip.

One 386 drives the loudspeaker for aural monitoring. The other drives the meter. An even better meter driver might be constructed from an op amp, such as a 741 or TL081, which could drive the meter directly without help from a transformer.

The calibrated voltage attenuator is simply a resistive divider across the input. A standard shielded probe with a ground clip is used for pickup. A blocking capacitor keeps dc from being applied to the divider, and hence to the FET preamplifier gate.

The entire voltage divider, with its switches, lead wires, and input capacitor, should be shielded from stray pickup. Without shielding, it is subject to hum, rf, and other stray pickup which shows on the meter and is audible in the monitor. The input impedance is approximately one megohm. Many of the pickup problems can be solved by shunting the whole string with a one-meg (or lower value) resistor, thereby lowering the input impedance without changing the 10-dB interval between attenuator taps. (If this is done, it is necessary to recalculate the value of R7 to give 50 dB attenuation with the new divider resistance.) You might provide a switch to do this, so that you can retain the one-meg input impedance for use when you're working with very high impedance sources.

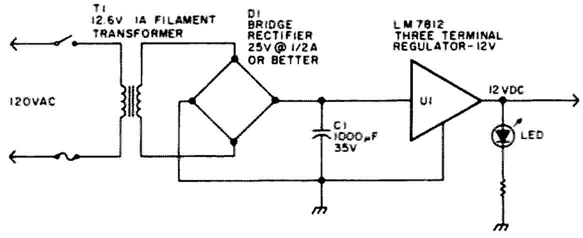


Fig. 2. Power supply for the VUM.

Resistance values are chosen such that each switch position gives 10 dB less signal than the one above it, for a total of 50 dB attenuation below the input signal. When the "high level" switch is flipped, an additional, fixed 50-dB attenuator is thrown into the circuit and the switch then reads in 10-dB steps from 50 to 100 dB below the input—and that's a *lot* of attenuation!

How do you determine the resistance values? That caused me a lot of floundering around with my trusty TI-55 calculator and a ream of paper smeared with several grams of graphite scribblings, but it finally came clear. As I said, the secret is that a dB is a *ratio* between two values, and you have to start with one known value and go from there.

You arbitrarily can assume a total value for the divider of one megohm, and calculate each step as a portion of that, or you can arbitrarily assume some value for R1 and calculate each step from there. I chose the latter because it enabled me to use a 10-dB ratio in all calculations, thus greatly simplifying the calculator work.

Now, let's go back to the basic formula stated earlier and solve it for 10 dB: 10 dB = 20 log V2/V1. Therefore, antilog V2/V1 = 10/20 = 0.5. The antilog of 0.5, obtainable from the calculator or a log table, is 3.1622777. So: V2/V1 = 3.16 and V2 = 3.16 V1.

In any purely resistive network, voltage divides in exact direct ratio to the resistance, so we can substitute R1 and R2 for V1 and V2 and restate the formula R2 = 3.16 R1.

Now, let's assume a value of 1000 Ohms for R1 (see Fig. 1). R2 is then 3.1622777 × 1000 = 3162 Ohms.

That gives us the values of two resistors in the string. Now let's get the value of R3. We want a value which will give us 10 dB less voltage across R1 + R2 than is applied across R1 + R2 + R3. So, R1 for this calculation is actually the sum of R1 and R2, or 4162 Ohms. Therefore: R3 = 3.16 (R1 + R2) = 3.16 × 4162 = 13,146 Ohms.

To get the value of R4, use the same method, making "R1" equal the sum of R1 + R2 + R3. And so on, until you have the value of all six resistors in the string.

Now, it happens that 1000 Ohms is a standard resistance value. That's why I chose it. Three thousand Ohms, however, is not a standard value, and 3162 certainly is not! However, 2700 and 470 are standard values, and they add up to 3170 Ohms, which is only 0.2 percent off the calculated value! Certainly close enough for amateur work.

13,146 isn't standard, but 13k is, and it is only about 1.0 percent off. If you want to be *really* finicky, you could use 13k and 150-Ohms in series, but, unless you're using very expensive 1% tolerance resistors, the difference is academic. Five percent is certainly close enough and ten percent probably will do nicely.

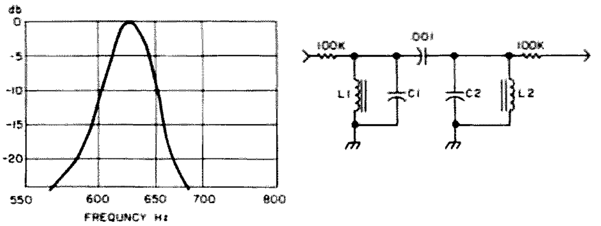


Fig. 3. Frequency response of two-toroid CW filter determined with the aid of the VUM. L1, L2—88-mH toroids; C1, C2—0.68 μF. Bandwidth: 25 Hz at −3 dB; 40 Hz at −5 dB; 55 Hz at −10 dB; 60 Hz at −15 dB.

Calculated values of the other resistors can be approximated in the same way, using standard values in series, parallel, or series-parallel. In most cases, quarter-Watt composition resistors will do fine. However, compostion tends to change value slowly over a period of years, especially when subjected to heat and/or high-voltage stresses. You could avoid this with metal film resistors, at much expense, but one-Watt or even two-Watt composition resistors will hold their values for many years before they change enough to affect the accuracy of your readings.

The resistors are easily mounted on a small piece of perfboard with wires running to the six-position rotary switch, but keep the leads fairly short, keep them away from output leads going to the speaker or meter, and keep them away from power-supply leads. If possible, enclose the whole resistor bank and switch in a shielded compartment, though this may not be necessary.

The FET amplifier is not needed to provide gain, though it provides about 10 dB. It is there to offer a very high impedance to the voltage divider. The input impedance of the LM386s, in parallel, is about 25k and if this impedance paralleled the attenuator, it would seriously affect the accuracy of the steps, especially at the small attenuation settings. Any inexpensive audio-type N-channel FET will work nicely. The FET drives the two pots which provide separate level controls for the amplifiers.

The meter amplifier is coupled to the 4-Ohm winding of a small audio transformer with a 500- or 600-Ohm secondary, such as those used to couple speakers to music distribution lines. The purpose of the transformer is to step up the low-voltage output of the amplifier to the higher voltage which the meter needs. The meter is designed to work across a nominal 600-Ohm load.

Except for lead dress and shielding of the input circuits, nothing is critical about construction. The audio amps, including the FET circuit, can be built on a single universal circuit board such as the "experimenter printed circuit board" sold by Radio Shack (catalog number 276-170) or any other "universal" board with 0.1-inch perforation centers. It can be built on perfboard without foil using wire-wrap or point-to-point wiring.

A regulated power supply (Fig. 2) using a three-terminal 12-volt IC chip is used because the regulator provides a high degree of hum filtration. Voltages are not critical at all, but don't exceed 15 volts—the 386s cannot take more than that. Nine-volt batteries should work fine.

After checking for wiring errors, plug in the ICs and check for output. You should find none until you provide an input signal. If hum appears on the meter and/or in the speaker, especially at the 0-dB attenuation setting, short out the probe terminal and see if it disappears. If it does, your problem is hum pickup in the attenuator board.

Occasionally IC amplifiers will oscillate. This would show up as squeals, hisses, crackles, and distortion in the speaker and as a reading on the meter, even with the probe input shorted or switched to high attenuation. This usually can be cured with an RC filter (0.05 μF and 10 Ohms in series) from the IC output to ground. Sometimes a 0.005-μF capacitor across the input terminals at the IC will be necessary. The FET can be eliminated as a suspect oscillator by grounding its gate or by removing its drain voltage.

After checking out and debugging, hook a source to the input of the VUM. The best source is an audio oscillator, but for this test, any steady tone will do.

You should hear it in the speaker and should be able to adjust its loudness with the "volume" pot.

The tone also should register on the meter. If it pegs the meter, rotate the attenuator switch until the meter drops back on scale. If little or no meter reading occurs, set the "calibrate" (Cal) pot at about half rotation or a little more, and then, if necessary, rotate the attenuator switch toward the 0-dB position.

Checking Calibration

Adjust the output level of the oscillator until you can set the attenuator at 0 dB and get the meter down to 0 VU (about two-thirds scale) with the Cal pot. Now flip the attenuator to −10. The meter should drop to −10. Reset Cal and, if necessary, the oscillator output, to get 0 VU again, and switch the attenuator to −20. The meter should again drop to −10.

Check all six steps in the attenuator in this way. You may find it necessary to adjust a resistor value here or there to get exact 10-dB steps. (Remember that R6 controls the first step from 0 dB to −10 dB. R5 controls the next step and so on.)

The full range of the Cal pot will give you about 25 or 30 dB of adjustment.

Using the VUM

Now you're ready to put the VUM to practical use. You have an audio filter for use in CW reception. How sharp is it? Put it on the bench and arrange to drive its input with the audio oscillator instead of the receiver. Be sure that the input and output of the filter see the same impedances they see when it is in the receiver, then put the VUM across the output of the filter. Let's assume that the filter was designed to peak at 700 Hz.

Adjust the frequency of the oscillator until it hits the filter peak, giving maximum reading on the VUM. Select an attenuation on the switch which will let you set the meter on 0 VU with the Cal pot.

Note that your oscillator frequency is 690 Hz when the filter output is peaked—pretty close, if you designed it for 700 Hz. Now, keeping the output level of the oscillator the same, switch the frequency to 700 Hz. You'll note a slight drop in the VUM reading. Note that at 690 Hz, the VUM read 0 VU and at 700 it read, say, −0.5 dB.

Change frequency again, to 710 Hz, and note that the meter reading drops to −1 dB (or VU). Keep going up frequency one step at a time until your meter readings drop below −20 dB. Then go down frequency from 690 Hz a step at a time, noting the meter and frequency readings each time.

When you finish, plot your results on a piece of semi-log graph paper, using the logarithmic scale for frequency and the linear scale for your dB readings. The results will be similar to those in Fig. 3, which represents an actual two-toroid CW filter I've used for years. The response curve was plotted with the aid of the VUM.

In a similar manner, you can determine the frequency response of a stereo amplifier, beginning in the middle of the audio range, say at 1000 Hz, to establish a 0 VU reference point. You will note that the meter readings begin to drop off as the frequency reaches some low value, perhaps below 100 Hz, depending on the quality of the amplifier. A similar drop-off occurs at the high end of the audio range, say, above 15 kHz.

The frequency response curve of the VUM itself is shown in Fig. 4 and this must be taken into account when testing another amplifier. The low frequency drop-off is caused, most likely, by the core losses in the small output transformer used to couple the amplifier to the meter. Up to a certain point, increasing the value of the output coupling capacitor will extend the low frequency response. You should use at least a 3000-μF coupling capacitor.

An op amp, such as an LM741 or TL081 driving the meter directly and omitting the output transformer, probably would improve the extreme low end response of the VUM. Since I have seldom, if ever, been called on to make accurate measurements at these frequencies, I have not explored that improvement. The high frequency response is virtually flat at least to 40 kHz.

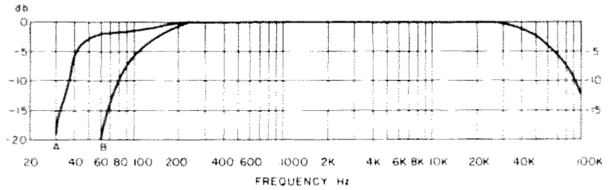


Fig. 4. Frequency response of the VUM. ±1 dB, 100 Hz to 40 kHz; ±3 dB, 40 Hz to 65 kHz. A—response with 200-μF output coupling capacitor to meter. B—1200 μF.

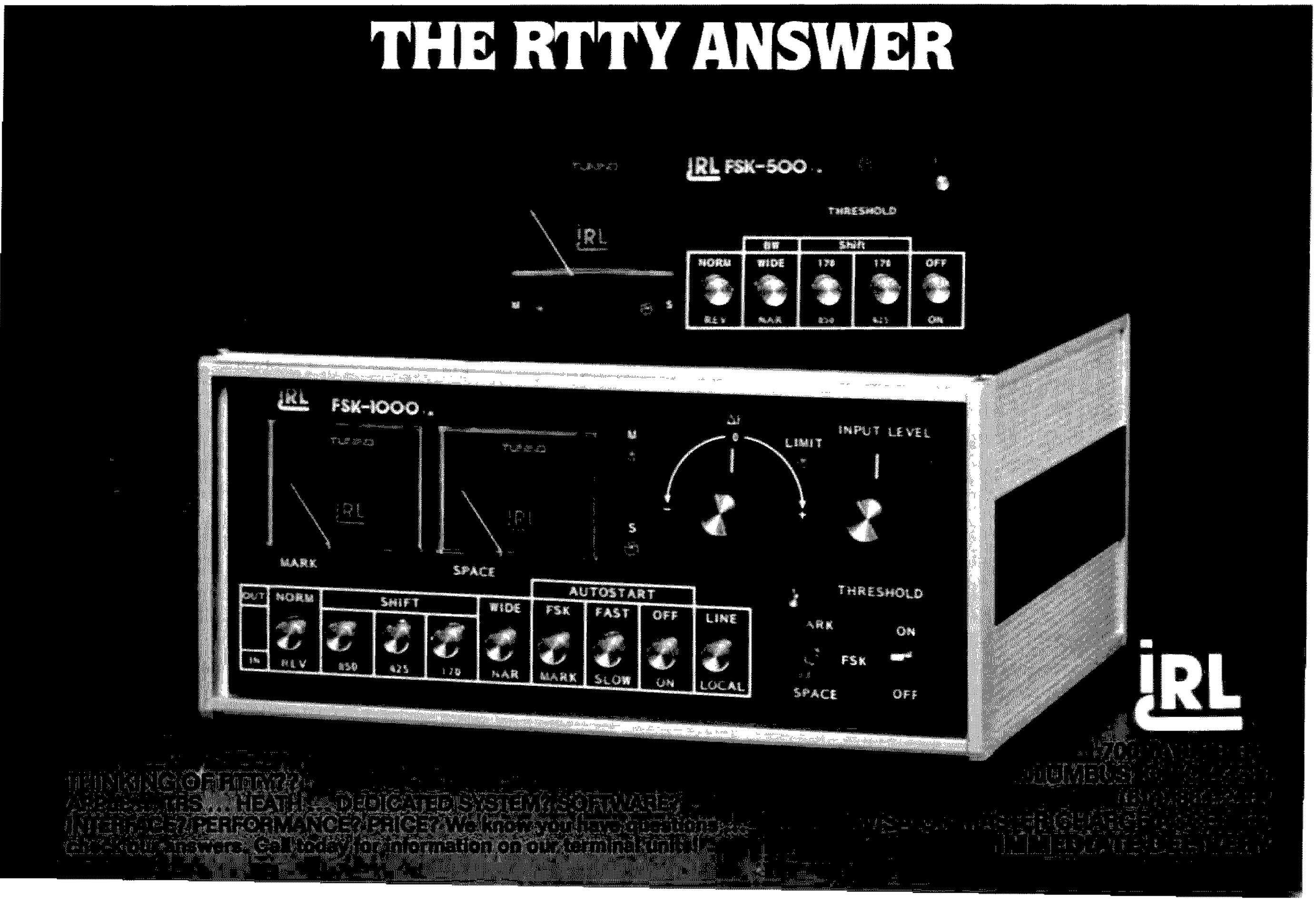
Now, suppose you have a solid-state audio amp which gives only low, distorted output. Apply a tone, such as 1000 Hz, to the input, at a level which the amplifier is designed to handle. Apply the probe of the VUM to the input, adjust the attenuator, and set Cal for 0 dB on the meter.

Now move the probe to the output of the first stage in the amp and note that you must switch in two more steps of attenuation—20 dB—and the meter then reads +2. (Don't touch Cal.)

The readings translate to mean that the first stage is providing 22 dB of amplification—a very healthy performance.

Reset Cal to give 0 on the meter and move the probe to the output of the second amplifier stage. This time, it isn't necessary to switch in any more attenuation. The meter reads −5 dB. That "amplifier" stage is offering a 5-dB loss! It is obviously sick and needs TLC.

The uses of the VUM are numerous and you probably can think of other ways to use it to compare the levels of any two audio signals. Often, that tells the whole story. ■



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Kenosha WI 53142

Analog Isn't Dead

—don't be LED astray by the digital revolution

Sometimes it seems that everything is going digital. At first it was a novelty to have a digital clock—you know, the kind with the metal plates that would flip down a new number every minute. With the emergence of the cheap LED seven-segment device, the movement to digitalize everything accelerated. First it was digital watches and clocks, then calculators; now it's used on thermometers, bathroom scales, radio dials, gas pumps, and almost everything on some luxury cars. Even a farmer friend of mine brags that the speedometer and tachometer on his new tractor is digital. Digital is becoming synonymous with modern, while analog is considered outdated. Is the analog device a twentieth-century dinosaur doomed to extinction in this era of rapidly advancing technology? The answer is a definite "no!" Old Charlie Darwin would agree that as long as a species is successful within its niche, it will survive. As it has evolved because of technology, the digital species has displaced the analog species from certain niches in which the analog species was only marginally fit, yet digitals are unable to compete with analogs in other areas.

Analog and digital devices each have distinct advantages and disadvantages. By understanding the merits of each system, the designer/user can intelligently select the better device. As a rule, a merit of one system is a shortcoming in the other system.

Precision

The digital device wins hands-down in the precision department. Precision is limited only by the number of digits you can afford or can read without confusion. But don't get confused between precision and accuracy. Accuracy is the measure of how close you are to the real value, while precision is the measure of your confidence in the measured value. If your new Rockcruncher 2000 all-digital transceiver says that you're transmitting on 21,447.605 kHz (a very precise measurement), but you are actually transmitting on 21,452 kHz (a very accurate measurement), then you are still likely to get a pink slip from the FCC. Moral: An ounce of accuracy is worth a pound of precision. However, if you have a high degree of accuracy but low precision, you won't be able to know just how accurate you are. You just won't collect as many pink slips.

Quick quiz: Which digital frequency meter is better (greater accuracy and precision) for measuring a signal at 420.0000000 MHz: a 6-digit meter with 1 ppm accuracy or a 10-digit meter with 4 ppm accuracy? Answer: Of course you knew all along that it was the 6-place meter, because:

6-place counter:
1/1,000,000 × 420.0000000 + 420.0000000 = 420.000 (remember, only 6 digits).

10-place counter:
4/1,000,000 × 420.0000000 + 420.0000000 = 420.0016800.

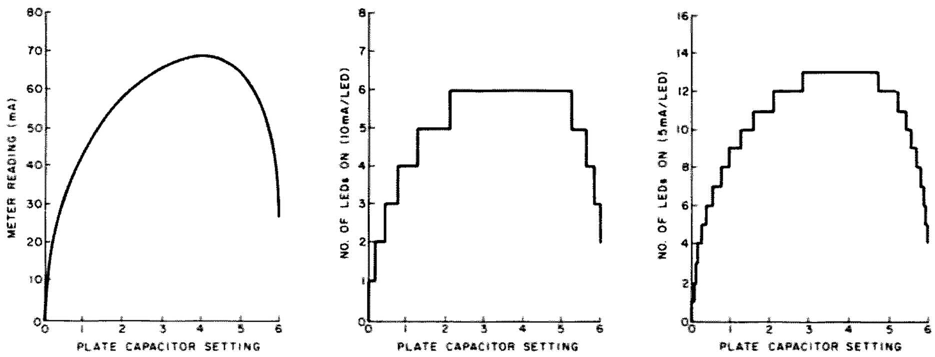
Wow! The 10-place counter is really impressive with all those numbers. It's too bad that the accuracy extends only to five significant figures. The 6-place counter is not as flashy, but it provides accuracy and precision to six significant figures.

The slide rule was displaced by the digital calculator simply because the slide rule was unable to compete with the superior accuracy and precision of the digital calculator.

Rate Measurement

Imagine that you have decided to update your old Rockcruncher 1000 (1967 model with analog frequency dial and old-fashioned D'Arsonval swinging-needle meter movement). Being short of funds, you select a $19.95 3½-digit LED meter kit to replace the old analog movement. After three weekends, one trip to the hospital emergency room, and the kind assistance from a friend who just happens to have an MSEE degree, you get the thing installed. To celebrate the occasion, you turn on the rig to 40 meters for a little QSO to brag about how you dragged your old Rockcruncher 1000 kicking and screaming out of the 1960s and into the 1980s.

As you tune in the first station, you get the first hint that all is not well with your new, state-of-the-art, digital



(a) (b) (c)

Fig. 1.

meter. It is impressive to see all those LEDs flashing, but it would be better if they were readable instead of blurred. Well, that's the price of progress.

Then you start to tune up the rig. The old peak-and-dip ritual is suddenly a wild and crazy experience. Unless you tune very slowly, the meter displays a string of eights. Not only that, but finding the peaks and dips is almost impossible. Unfortunately, the final tubes hate non-resonance so much that by the time you are almost tuned up, they collapse in a molten puddle.

Exaggerated? Well, maybe, but the point is that digital displays are not suitable for measuring rapidly changing values. The digital display blurs, while the analog display provides a usable rate-of-change display by observation of the angular velocity (sweep speed) of the indicator's pointer. An example would be to compare the analog and digital display of an aircraft's altitude. During an aircraft's descent, the analog altimeter's pointer "unwinds" at a velocity proportional to the slope of the descent. The display remains readable at all times. The digital display will blur in the units position during the slightest descent, and as descent rate increases, the tens, hundreds, and eventually thousands positions will blur. While the analog altimeter provides continuous rate information over a wide range (slow "unwinding" through fast "unwinding"), the digital altimeter displays the descent rate in a limited number of discrete steps. For example: units blurred—slight descent; tens blurred—moderate descent; hundreds blurred—steep descent; thousands blurred—dive; ten-thousands blurred—don't even think about it.

Why do race cars still use old-fashioned analog tachometers instead of the spiffy new digital tachometers that Warshawsky and Co. sells? It comes down to economics. An over-revved engine with pieces littering the track simply cannot win a race. If a digital tach blurs on acceleration, the driver will be more likely to overrev the engine (an expensive mistake). The subject of race car instruments leads into the next criterion for selection of the appropriate analog or digital device.

When I first saw the instrument panel on a race car, I noticed that the instruments were installed askew, with some turned clockwise and others turned counterclockwise. Later I was informed that it wasn't sloppy installation, but an intentional arrangement. The driver doesn't have time to read the numbers on each gauge, so the gauges are aligned so the pointer is at 12 o'clock at the ideal (or maximum) setting. A deviation is then readily noticeable. An analog device will show where you are with respect to the range of position. An analog defines its limits (empty-full, low-high, 0-1 mA, 0-120 mph) and the device's pointer simultaneously indicates its relative position on the range of values.

Comparing the ability of analog and digital devices to measure position can be demonstrated by the story about the hot-air balloonists who became lost while drifting over the countryside. One of the balloonists sighted a farmer in a field and began releasing gas from the balloon. As the balloon passed over the farmer, the balloonists yelled, "Where are we?" The farmer replied, "'Bout a hunnerd foot up in a hot-air balloon." The information transferred was absolutely correct, yet absolutely useless since there was neither a horizontal point of reference nor a distance and direction from the point of reference. Frequently a value alone can be meaningless unless accompanied by boundary limits. When using digital devices, you often must be aware of limits which are not displayed. Since analog devices display the entire range, hazardous or undesirable regions may be flagged by using a colored band as a warning marker. This flagging is generally not available for digital displays; however, red/green bidirectional LEDs in a 7-segment configuration could be used in circuitry that would allow a color change as an undesirable region is entered.

Another kind of position utilization in analog displays is incremental measurement. A good example is the wristwatch worn by a nurse. It is never digital and always has a second hand. The reason is that nurses take frequent readings of patients' vital signs—pulse and respiration. To save time (a survival skill in nursing), the pulse and respiration are each measured for 15 seconds. The procedure is to find the pulse, start counting the pulse as the second hand passes any 5-second increment, continue counting until the second hand has traversed 90° from the starting point, and finally multiply this 15-second count by 4. The starting and stopping points are of no consequence, but rather the 90° sweep of the second hand which measures a 15-second increment. A similar incremental measurement is used in transmitter tuning. The actual plate current reading is of little value until tuning is completed. The important things are the relative peaks and dips as the circuit is brought to resonance.

Continuous vs. Stepped Readings

There is a little gadget on the market called the LED bar-graph display which looks like an analog device, yet is still digital. It has the advantage of position display and may be used marginally for rate measurement. Its weakness is the one distinct advantage usually found in digital devices—precision. Precision is limited by the discrete number of steps (LEDs) on the bar display. If 8 LEDs

are used to measure a range of 0 to 8 units, then no LED would light until one unit is reached, the second LED would light only when two units is reached, and so on. The drawback is that 1.00 and 1.99 units are displayed as being the same. Now it's obvious that trying to use this bar graph to tune a transmitter would be difficult. Fig. 1 shows a comparison of a D'Arsonval meter movement and two LED bar graphs. Fig. 1(a) shows the actual plate current (as displayed on the D'Arsonval meter). Fig. 1(b) shows an 8-LED bar graph, and Fig. 1(c) shows a 16-LED bar graph. The "peak" on the 8-LED bar covers over half of the capacitor tuning range, and the 16-LED bar-graph "peak" covers over a third of the capacitor tuning range. Neither bar graph has the sensitivity for tuning that the analog display has.

Conclusions

Use a digital device where precision is needed, but remember that high precision cannot improve accuracy. Digital devices are especially suited as frequency indicators on transceivers and frequency counters. However, if the frequency counter you are thinking about buying has 9 digits and 10 ppm accuracy, then you are wasting money on the last 4 digits. Six digits and 1 ppm accuracy is just right. Don't use an LED bar graph if precision is essential.

If position-orientation, -tracking, or -setting are important, stay with an analog device. And finally, rate measurement belongs to analog devices.

As an equipment designer/user, select the better device to meet your own needs—even if it means being old-fashioned. ■

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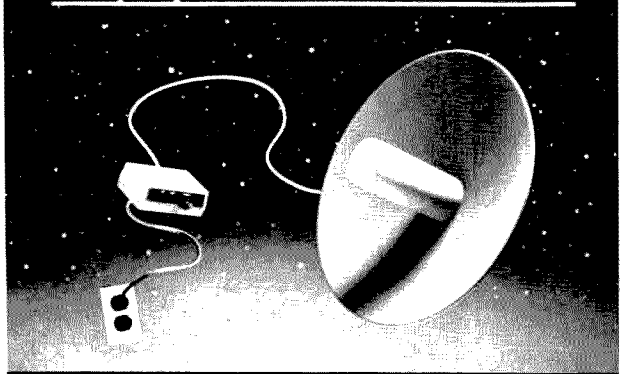

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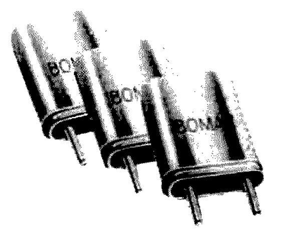

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Line Voltage at a Glance

—at last, a useful gadget

L. B. Cebik W4RNL
5105 Holston Hills Road
Knoxville TN 37914

A line voltage monitor can help you protect your equipment investment from problems that fuses and circuit breakers cannot cure. However, most monitors start with relatively expensive meters. To expand their scales for the 90-to-140-volt range may require additional circuitry. There must be an easier way.

The little monitor described here is inexpensive, easy to build, and provides LED indication of the line voltage in five-volt increments, which is as close as most of us need. Its accuracy is good because you can calibrate it against factory- or lab-calibrated instruments. Finally, the entire works are small enough to fit inside another piece of gear, or you can use a separate small case. Apart from the case, $10-12 should buy you new parts, although I suspect most junk boxes have everything exept the IC and the LEDs.

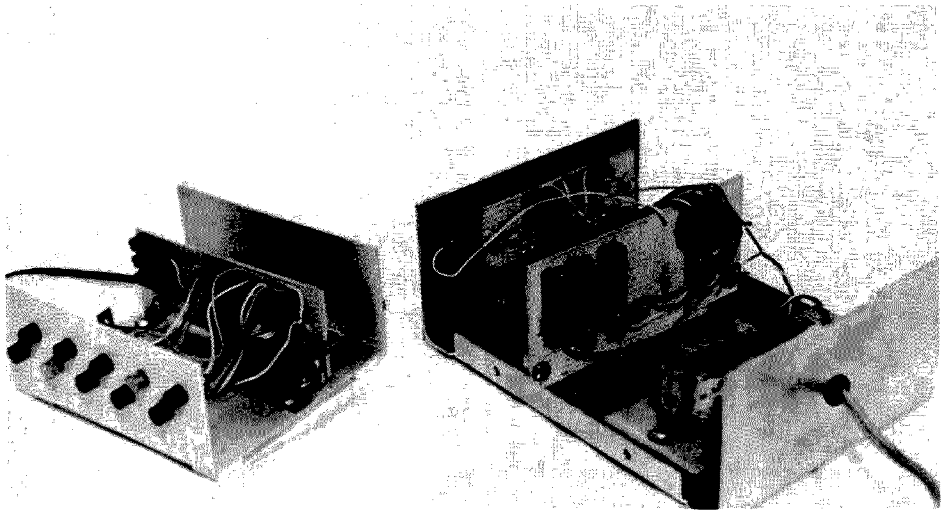
Monitoring the line voltage to the shack has always been fairly important. In recent years, the increasing incidence of brownouts and other line variations has made monitoring even more important. Occasionally voltages will rise or fall to levels which may endanger some equipment, especially motorized equipment. Less catastrophically, a line voltage monitor can help you trace unusual glitches, such as excessive power consumption, to the voltage entering the equipment. At the end of the article, we will look at some applications of the simple monitor described here.

The Circuit: An LM3914

The LM3914 dot/bar display driver is a versatile 18-pin IC available from many sources, including Radio Shack. Pins 1 and 18 through 10 provide terminations for LEDs, which can be set up to come on one at a time or to come on progressively, depending upon how pin 9 is connected. Pins 2 through 8 provide the supply, control, and signal inputs. Fig. 1 shows the basic layout of the chip.

The 3914 consists of a highly accurate voltage divider chain controlling the LED pins through complex internal circuitry. By setting the high and low limits of the divider, we can achieve a smooth linear progression of lights as the voltage moves up and down at the input terminal, pin 5. Most applications of the 3914 are geared to low voltages, such as audio voltage meters, battery checkers, and the like. However, with a little care, we also can have the 3914 track higher voltages.

To make the 3914 function as a line voltage monitor, we simply need a low dc voltage which varies with the rms value of the ac voltage at our wall plugs. A 9- to 12-volt dc power supply with a relatively constant load will do just this, if the supply is loaded neither too lightly nor heavily. Additional drops across a resistor will also track the ac. In the circuit shown in Fig. 2, tracking by these means has proven as accurate as the expanded-scale ac meters against which the unit was checked.



Interior view of these monitors shows two layout possibilities using perfboard construction.

The circuit in Fig. 2 is an adaptation of the 3914 configuration used by Weinstein and Gartman in their auto battery checker.[1] The resistor divider networks connected to pins 4, 6, and 8 set the lower and upper limits of the readout, while the resistor connected to pin 7 controls the brightness of the LEDs. Pin 5 samples the incoming voltage across another resistor

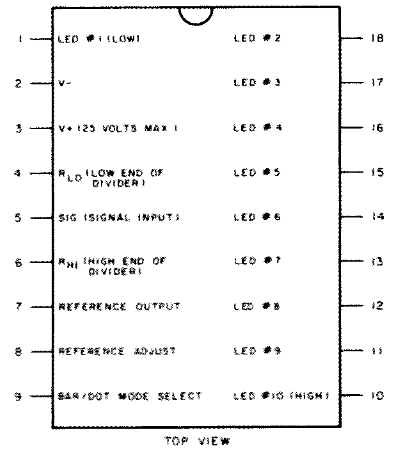


Fig. 1. Pinout of the LM3914 dot/bar display driver.

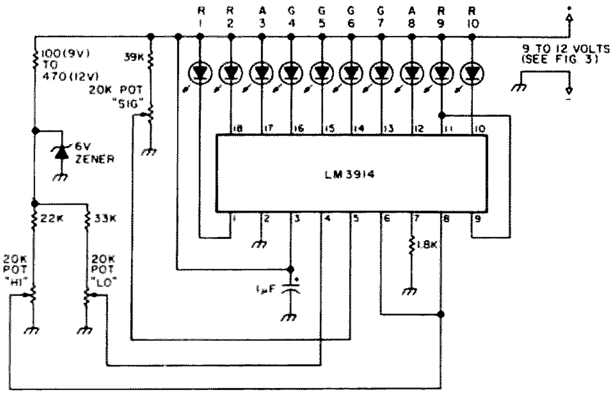


Fig. 2. The metering and LED sections of the line voltage monitor. LEDs: R = red, A = amber, G = green.

divider. Jumpering pins 9 and 11 allows the LEDs to light one at a time.

Each LED lights for a five-volt increment from 90 to 140 volts. The one exception is the last LED, at the upper limit, which remains lit when the voltage exceeds 140. The 50-volt range was chosen for several reasons. First, 50 divides neatly by 10. Second, the middle four increments cover the range from 105 to 125 volts, the recommended range for the operation of most electronic equipment. Hence, the readout has a nice symmetry. This fact also allowed me to use different colored LEDs: green for the safe range, red at the dangerous extremes, and amber in between.

The zener in the line feeding the limit-setting resistors is needed to hold the voltage constant to the limit pins. The exact value is not critical, as long as a range of 1 to 3 volts is available from the potentiometers. The pots are 10-turn miniature trimmers for ease of calibration. (Remember that what is called a 10-turn mini pot may have from 8 to 15 turns depending upon the model and manufacturer.) The input trimmer is the same sort of miniature potentiometer, set to give around 2 volts for an ac rms line voltage of 110.

The LEDs can be any type of the many available across the counter or through mail sources. The object is to create an easy-to-read display, remembering that pin 1 is the lowest, pin 18 is next, and pin 10 the highest value. The 1.8k resistor controls the brightness of the LEDs, and the value shown provides an easy-to-read level without being too obtrusive.

The remainder of the circuit is shown in Fig. 3 and consists of two different power sources for the meter. The original prototype was built with power supply components on hand, while a second version uses a 10-volt ac adapter, with the parts molded into the plug. Anything from 9 to 12 volts will work, so that the ac adapter for a dead transistor radio, tape recorder, etc., can be pressed into service with good results. The meter requires little current, so the current capability of the power supply is not a problem. However, whether you opt for a home-brew supply or an adapter, additional filtration and a load resistor (the 1k resistor in the schematic) are needed to provide a minimum load on the supply.

Construction and Components

The meter itself, as shown in Fig. 2, will fit on a 2″ × 3½″ piece of perfboard, assuming the LEDs are panel-mounted elsewhere. A socket for the IC simplifies wiring. Since only a few of the IC pins have more than one connection, wiring is so easy that no printed-circuit techniques have been used, although an enterprising builder might wish to create a board for himself.

Again, with the exception of the LEDs, there are so few external components that layout is no problem. The only caution is to mount the trimmer pots so that they are accessible for calibration. Since they are of the same value, it will pay to label them as HI, LO, and SIG. There is nothing more exasperating than to have the unit in the final tweaking stages of calibration, only to move the screwdriver adjustment of the wrong pot and have to start over.

Different types of LEDs and panel arrangements can be used with equal success. Rectangular bar-graph LEDs from Radio Shack have been used in one model. They are mounted on a piece of perfboard, with leads running to terminal pins on the board. A smaller unit uses jumbo LEDs in plastic mounting lenses. The zigzag line of ten LEDs across the face of the unit makes identification of the five-volt increment very easy, and once panel markings are added, readout is even simpler.

Fig. 4 shows a sketch of the front panel with the colors of LEDs identified. The arrangement from red through amber to green and back again is not only symmetrical, but also reflects the levels of potential trouble from line voltages that wander too far from the norm. In purchasing LEDs, especially green jumbos, be sure to buy more than you need and match them for brightness. The reds and ambers seem to be most consistent, but surplus greens appear to vary quite a bit.

The importance of using LEDs of approximately the same brightness stems from the fact that as the voltage nears a transition from one increment to another, two LEDs may be lit simultaneously. If the LEDs are well-matched, the relative brightness of the two will tell you which side of the dividing line the voltage is on at a given moment. Mismatched LEDs can misinform you. This trouble was not encountered with bar-graph LEDs. The degree of overlapping of LEDs seems to vary from IC to IC, but in no case has it proven to be such a problem as to produce false impressions of the line voltage.

If you use a home-brew power source, you can

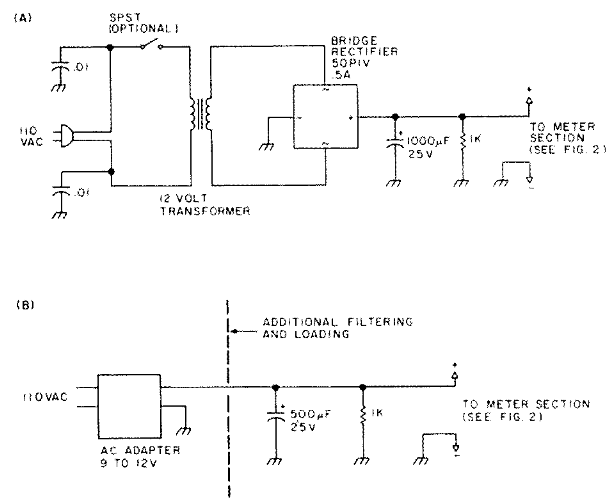


Fig. 3. Power and signal source for the line voltage monitor. (a) Home-brew power source. (b) Ac adapter module power source.

build it on a separate board or use one board for the supply and meter sections. With an ac adapter, the additional components can go on the meter board with the IC and pots. The only precaution with the power source is to use it for no other purpose. The varying load created by a secondary use will alter the voltage to the signal input, destroying the utility of the meter.

The entire assembly is compact and will fit cases as small as 2"×2"×4" (with an ac adapter supply). The components also can be mounted within another piece of equipment as long as there is room somewhere for the LED display. If your shack has a master ac control panel, a small corner will be enough for the LED array.

Calibrating the Meter

Many of us have grown accustomed to using fixed components or having equipment factory-calibrated. In the process, we may lose sight of the fact that building an adjustable circuit can lead to a far more accurate instrument. Hence, potentiometers have been used rather than fixed voltage dividers.

The line voltage monitor described here can be calibrated at two levels of accuracy: close and right on. Close calibration requires only a fairly accurate VTVM and a little arithmetic. To get the meter right on requires a factory-calibrated meter (for ac and dc voltages) and a simple test circuit. The close calibration technique is also a good preliminary step for later, more precise calibration.

Let's begin with a little math. Suppose we let a signal input voltage of 2 volts dc to pin 5 of the LM3914 equal 110 volts ac. The voltage division factor is 55. (We could, of course, use other ratios, within limits.) This factor will apply throughout the meter range. Dividing 90 volts ac by 55 gives us a value of 1.64 volts dc as the lower limit control. Measure the voltage at pin 4 and set the LO pot for this voltage. Similarly, 140 volts ac divided by 55 gives 2.55 volts dc as the value we want at pin 6; adjust the HI pot for this value. The HI and LO pots may interact a bit for this degree of accuracy, so tweak both several times to set the final values. Now adjust the SIG pot until the correct LED lights for the actual value of ac voltage.

Use caution here. Most kit VTVMs were aligned for 110 volts ac from the existing line voltage. Thus, they will be no more accurate on ac than the original adjustment. If you can borrow a well-calibrated instrument or visit a lab bench for a few minutes, you can set the line monitor on target quickly. Do not expect to read exactly 2 volts for 110 volts ac, because there will be a slight offset, but the degree of inaccuracy caused by this is under 1 percent. With a little tweaking back and forth of the signal input pot, you will be able to set the voltage very accurately by watching for the overlap effect on the LEDs.

The monitor is very usable calibrated this way, but if you wish to be more accurate, try the circuit in Fig. 5. This circuit lets you vary the ac voltage to the monitor across the full range of the instrument. Use care, because the voltage can be lethal, and there is a tendency to grow a bit careless after handling the low voltages we use on ICs. The 5k pot should be 4 Watts or more and well insulated from your hands.

As the drawing shows, we will monitor the line voltage as we calibrate the meter. If we wish, we also can monitor the voltage to the control and signal pins, but this is not strictly necessary. If we have performed an initial calibration as described above with some care, we should be close enough to make the precision calibration easy.

First, recheck that the correct LED lights with a voltage in the 110-to-120 range. Now we will run the ac voltage up and down, checking the voltage at which the LEDs change from one to the next. (For these tests we will ignore the absolute limits, since the transitions are more accurate.) If the voltage transitions are not at the five-volt marks and they are consistently off by a constant amount in the same direction (for example, a volt too high or a volt and a half too low), then adjust the SIG pot to bring the transitions on line. If the amount of error at transition toward the low end of the scale is not constant after bringing the SIG pot as close as possible to the right point, then adjust the LO pot until the changes, especially the 95-volt transition, are correct. Do the same for the upper end of the range.

Remember that the two pots may interact just a bit, so recheck each end of the line. Be sure to make all adjustments slowly, and verify that you are moving in the correct direction before making a sizable change. Large hasty changes can throw everything off. But if everything does go askew, you can set it back in the ball park with a repeat of the first alignment procedure.

Now recheck the alignment, and you should be right on. At most, you may have to adjust the SIG pot a hair more. Although the resistor divider circuits show combinations of fixed and variable resistors, they could be replaced by 50k pots. However, there would be a loss of fine calibration control, so the cost of the three fixed resistors is well justified.

After using the monitor for several weeks, recheck the calibration. Components do change value during their lives, but most of the change (if not catastrophic) is either very early or very late in their lifetimes. Hence, after "burning in" the monitor for a few weeks, a check of the calibration should produce a stable monitor that needs to be tested only during your regular station maintenance checks.

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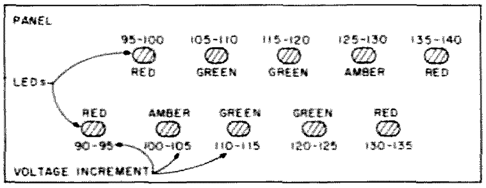

Fig. 4. One of many possible panel layouts for the LEDs.

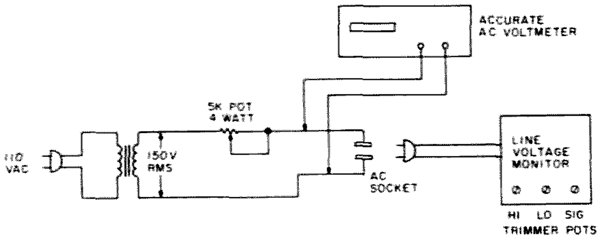

Fig. 5. Test setup for calibrating the line voltage monitor.

What the Monitor May Tell You

The line voltage monitor described here is designed to be accurate, but not to yield precise voltage measurements. Within close limits, it will indicate the five-volt range of the current ac line voltage feeding your equipment. For many purposes, these readings will be sufficient. Closer readout of the voltage requires either a meter or a redesign of the present circuit. By adjusting the upper and lower limits, a smaller voltage range can be spread across the same ten LEDs. For example, within the general parameters of the two-step calibration procedure described earlier, setting the LO-HI range between 2.09 and 2.27 volts would permit you to read the ten volts between 115 and 125. If such precision is desired, a second set of resistor dividers might be switched in and out of the circuit (in place of the 50-volt dividers) with a DPDT switch.

Since the primary function of a line voltage monitor in the shack is to warn of possibly dangerous conditions, such precision is rarely required. Most of the monitor's utility is provided by the wider limits. This is especially true in this day and age of brownouts, when power companies—with or without warning—may lower the line voltage to 100 volts or less. Likewise, in some regions with a heavy industrial daytime load, early evening voltages have been reported occasionally to reach 135 volts.

Most household equipment, including ham gear, falls into four main categories: motors, lighting, heating, and electronic devices. Variations in line voltage can affect all four types of equipment, some more radically than others. Motorized equipment such as furnace fans, refrigerators, air conditioners, vacuum cleaners, stove fans, and the like all operate less efficiently as the voltage is reduced. Some types of motors can be damaged if the voltage drops too low and the motor is loaded heavily. In general, if the voltage either drops below 105 or rises above 125, it is best to shut down motors which must work hard. This includes air conditioners, refrigerators, power tools, and similar equipment. Lighter duty motors, such as fans, may be run to wider voltage limits, but do not be surprised should one fail. If any part of the motor has a weak spot, radical voltage excursions are one way of discovering it. These cautions do not mean that every drop or rise in voltage will mean catastrophe; rather, they are suggestions for preventing a possibly sizable replacement cost.

Lighting devices are generally of two sorts: incandescent and fluorescent. Light bulbs will react to line voltage variations by producing more or less light and heat. The power drawn by the bulb will vary approximately as the square of the voltage changes, since the current will also rise and fall with the voltage. The relationship is not exact, since filaments change their resistance with heat. While reduced voltage is an annoyance due to the reduced light output of bulbs, excess voltage is a bulb killer. A 10% voltage rise means approximately a 20% power increase, with an accompanying increase in heat. Using the national average ac line voltage of 117 as a standard, as little as 129 volts will produce this effect. Fluorescent fixtures are less evident in their reaction to line voltage variations, but harder starting may not always mean a bad condenser. A quick check with the line voltage monitor is in order first.

Electrical heating devices, such as stove and oven elements, are much like incandescent bulbs. Their heat output will vary as the line voltage varies, and so will the mechanical wear of the element. These are usually hardy devices, and often the adjacent wiring has a shorter lifetime than the element. Nonetheless, expect slower cooking during brownouts.

Electronic devices react to line voltage variations in many ways. Simple devices, such as tabletop radios and stereo equipment, usually show no effects from moderate drops or rises in line voltage. More complex equipment, such as television sets, may show some effects, especially with age. If accumulated dirt and other factors have lowered the high voltage to where it just holds the picture at full size, a brownout can show itself as picture shrinkage. Other effects are usually minor.

Critical equipment, such as computer terminals, should have heavy, very well regulated supplies, and the voltage feeding the regulator should not be marginal. If these conditions are met, then there are usually few problems. However, if the supply voltage to the regulator is marginal, a severe drop in line voltage may yield a temporarily unregulated supply, with consequent problems in TTL chips, memory, and other parts of the system.

Amateur transmitters and amplifiers will show the effects of line voltage variations in power output readings. In a transceiver or an average transmitter, plate voltage is usually not metered. Suppose your power output meter shows a 10% drop from the previous day's reading. One suspicion that naturally arises is that the final tubes might be going soft. However, a drop in line voltage can produce the same effect. A 10% drop in line voltage may reduce the plate voltage by 60 to 75 volts, depending upon transmitter design. Control positions also may change under these conditions, since the tube now exhibits a different plate resistance.

Rising line voltage also can yield misleading symptoms. Many of us have grown used to tuning up a transmitter to maximum power output, as read from an rf wattmeter or relative power indicator. A 10% rise in plate voltage may give us a temporary boost in power output, a condition which may make us proud for a moment of the equipment

manufacturer's ingenuity. However, if the line voltage is in fact high, then the best bet is to reduce power slightly in exchange for longer tube life. The miniscule difference in power at a receiving station cannot be noticed, but the cost of replacement finals is almost always noticeable.

Amplifiers capable of the maximum legal power for amateurs must have a means of measuring both voltage and current so that we can hold them within limits. Since most amplifiers are capable of loading to greater than 1000 Watts dc or 2000 Watts PEP input, we cannot simply choose a standard level of plate current and assume that we are within the legal power limit. A 10% rise in line voltage can produce a corresponding rise in plate voltage. Reducing plate current is then the only way to hold the power within limits.

These sample potential problems and conditions make a strong case for monitoring line voltage. Some of us are lucky enough to live in areas which never—or hardly ever—have brownouts. High line voltages are even more rare. However, the small price of a monitor will be more than offset if we detect a condition early enough to save the cost of a service call or replacement parts. For this degree of safety and preventive medicine, we need an accurate monitor, although we do not always need to know the exact number of volts. The LED line monitor described here can fulfill the need, while providing an interesting weekend of building and calibrating. ■

Reference

"Guard Your Battery with *PM*'s Charge Checker," Weinstein and Gartman, *Popular Mechanics*, May, 1979, p. 94.

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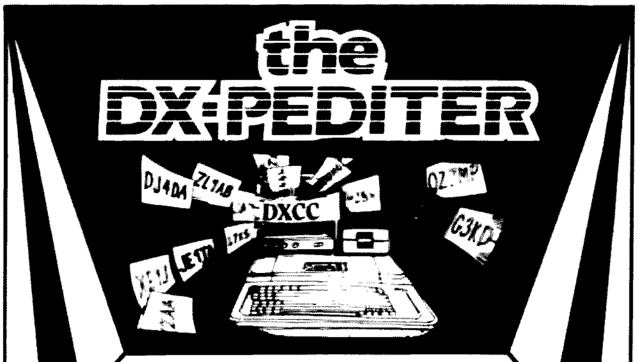

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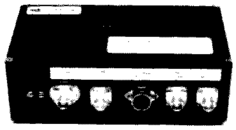

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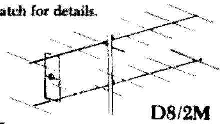

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SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received at 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458.

FLAGSTAFF AZ
JUL 30-AUG 1

The Amateur Radio Council of Arizona will hold its 32nd annual hamfest from July 30 through August 1, 1982, at the Fort Tuthill Fairgrounds, just a few miles south of I-40, Flagstaff AZ. There will be thousands of dollars in prizes, improved XYL activities, a swapfest, a transmitter hunt, speakers, forums, awards, exhibits, and entertainment on Friday and Saturday nights. Overnight camping facilities will be available. Talk-in on 147.870/148.270. For further information, contact Wm. Oliver Grieve W7WGW, 4301 N. 31st Avenue, Phoenix AZ 85017, or call (802)-246-0200.

KINGSFORD MI
JUL 31-AUG 1

The Mich-A-Con ARC will hold the 34th annual UP Hamfest on Saturday, July 31, and Sunday, August 1, 1982, at the Dickinson County Armory on M-95, Kingsford MI. Tickets are $2.50 at the door (no advance sales) and registration will begin at 9:00 am on both days. There will be prizes, family activities, and a Saturday night banquet. Advance banquet reservations are needed since seating is limited. Plenty of free parking will be available. Talk-in on 146.25/.85 and .3922. For further information, write UPHAMFEST-82, 105 East Breitung Avenue, Kingsford MI 49801.

ANGOLA IN
AUG 1

The Steuben County Radio Amateurs will hold the 24th annual FM Picnic and Hamfest on Sunday, August 1, 1982, at Crooked Lake, Angola IN. Admission is $2.50. There will be prizes, picnic-style BBQ chicken, inside tables for exhibitors and vendors, and overnight camping. (A fee will be charged by county park.) Talk-in on 146.52 and 147.81/.21.

PITTSBURGH PA
AUG 1

The 45th annual South Hills Brass Pounders and Modulators Hamfest will be held on August 1, 1982, from 10:00 am to 4:00 pm, at South Campus, Community College of Allegheny County, Pittsburgh PA. Admission is $2.00 or 3 for $5.00. There will be computer, OSCAR, and ATV demonstrations, as well as a flea market. Talk-in on 146.13/.73 and 146.52. For further information, contact Andrew L. Pato WA3PBD, 1433 Schauffler Drive, West Homestead PA 15120.

BELVIDERE IL
AUG 1

The Big Thunder ARC will hold its annual hamfest on Sunday, August 1, 1982, at the Boone County Fairgrounds, Route 76, Belvidere IL. Admission is $2.00 in advance and $2.50 at the gate. A fee will be charged for 8-foot tables and there will be indoor space available in the exhibit building, as well as outdoor space in swappers' row. Sellers will be able to set up Saturday evening or at 7:00 am on Sunday. Features will include door prizes, a main prize, food, and refreshments. Camping will be available on Saturday evening (there will be a charge for electricity). Talk-in on 146.52 and 147.975/147.375. For further information or tickets, send an SASE to Jim Grimsby, 418 Beacon Drive, Belvidere IL 61008.

LEVELLAND TX
AUG 1

The Hockley County Amateur Radio Club and the Northwest Texas Emergency Net will hold their 17th annual picnic and swapfest on Sunday, August 1, 1982, beginning at 8:00 am at the city park in Levelland TX. This event is for the entire family. Bring your own picnic basket for lunch at 12:30. A two-meter FM transceiver is the grand prize. A $3.00 registration is requested but not required. There will be swapping all day, with tables provided. Talk-in on .28/.88.

GLEN MI
AUG 1

The Black River Amateur Radio Club will hold the 29th annual Southwestern Michigan VHF Picnic on Sunday, August 1, 1982, at the West Side County Park near Glen MI. (Take exit 30 from I-196 and follow the signs.) There will be swimming, a playground, a small flea market, and door prizes. There is no food available at the park, so bring your own picnic basket. Registration is $1.00. For additional information, contact Ed Alderman KI8Z, RR #2, Box 44, Lawrence MI 49064.

POMONA CA
AUG 7

The Tri-County Amateur Radio Association will hold its annual hamfest/picnic on Saturday, August 7, 1982, from 7:00 am to 1:00 pm, at the Los Angeles County Fairgrounds, Pomona CA. All buyers, sellers, and computer buffs are welcome. There will be prizes, exhibits, and refreshments. Talk-in on 146.025/.625. For more information, write to TCARA Hamfest Chairman W6ELZ, PO Box 142, Pomona CA 91769.

JACKSONVILLE FL
AUG 7-8

The Greater Jacksonville Hamfest Association will hold the annual Jacksonville Hamfest and Northern Florida ARRL Convention on August 7-8, 1982, at the Orange Park Kennel Club, located near the intersection of I-295 and US 17 just south of Jacksonville. Advance registration is $3.50 and is available from Robert J. Cutting W2KGI, 1249 Cape Charles Avenue, Atlantic Beach FL 32233. Registration at the door is $4.00. The FCC will administer amateur and commercial radio operator exams on Friday, August 6th, at the hamfest site. Those wishing to take the exams should apply to the Atlanta FCC office as soon as possible. Swap tables are $12.00 per table for both days (no one-day tables) and table reservations, as well as advance registrations, are available from Andy Burton NX4G, 5101 Younis Road, Jacksonville FL 32218. A full slate of programs is scheduled, along with meetings of statewide and regional nets and organizations, plus competitions including a rabbit hunt and pileup contest. The headquarters hotel is the Best Western First National Inn just across from the hamfest. Special rates may be obtained by writing to Jim Canfield KD4CG, 996 Dostie Circle, Orange Park FL 32073. Talk-in on 146.16/.76 and 146.07/.67.

MONTGOMERYVILLE PA
AUG 8

The Mid-Atlantic Amateur Radio Club announces its annual J. B. M. Hamfest to be held on Sunday, August 8, 1982, from 9:00 am to 4:00 pm, rain or shine. Tailgate setup begins at 8:00 am. Located at the Route 309 Drive-In Theater, 1/4 mile north of Route 63, Montgomeryville, PA (6 miles north of the Fort Washington Interchange of the Pennsylvania Turnpike). Admission: $2.50, with $1.00 additional for each tailgate space. Non-licensed XYLs and children admitted free. Ample parking, refreshments, raffles, door prizes, and more. Talk-in on WB3JOE/R (147.66/.06) or 146.52 simplex. For further information, write the club, PO Box 352, Villanova PA 19085.

SAUK RAPIDS MN
AUG 8

The St. Cloud Radio Club will hold its annual hamfest on Sunday, August 8, 1982, from 8:30 am to 4:00 pm, at the Sauk Rapids Municipal Park, Sauk Rapids MN. Talk-in on 146.34/.94. For more information, contact Mike Lynch, 2115-1st Street, St. Cloud MN 56301, or call (612)-251-2297.

SONOMA CA
AUG 8

The Valley of the Moon Amateur Radio Club will hold its third annual ham breakfast and swap meet on Sunday, August 8, 1982, from 9:00 am to 4:00 pm, at the Sonoma Community Center, 276 East Napa Street, Sonoma CA. Breakfast is $3.50 each for adults and $1.75 each for children under 12. Waitresses will serve breakfast to people manning swap tables. Hot dogs will be served for lunch. Swap spaces are $5.00 each and tables can be set up beginning at 8:00 am. (Since there are only 30 tables available, plan to bring your own.) Admission, including a raffle ticket, is $1.00 and tykes, YLs, and XYLs will be admitted free. Featured will be computer displays and demonstrations, an operating 10-meter FM station, a Sonoma Valley Quilters' table, an amateur television display, an open auction at 2:00 pm, and a raffle at 3:30 pm. Talk-in on 147.47 simplex and 146.13/.73. For further information, call Darrel WD6BOR at (707)-938-8086; for swap space reservations, write VOMARC, 358 Patten Street, Sonoma CA 95476, enclosing payment of $5.00.

HOUSTON TX
AUG 13-15

The Texas VHF Society 1982 Summer Meeting will be held on August 13-15, 1982, at the Nassau Bay Resort Motor Inn, Johnson Spacecraft Center, Houston TX. Preregistration is $5.00 for all three days and includes one free ticket for a pre-registration drawing. Each additional prize ticket is $1.00. Registration at the door is $6.00 and does not include a prize ticket. There will be special tours of NASA, exhibits, a flea market, a ham astronaut speaker, space shuttle communications, and VHF and ARRL seminars. Prizes include an all-mode VHF transceiver. Talk-in on 146.04/.84 and 147.75/.15. For pre-registration information, write Texas VHF-FM Society, Summer Session, c/o PO Box 73, Texas City TX 77590.

TACOMA WA
AUG 14-15

The Radio Club of Tacoma will hold Hamfair 82 on August 14-15, 1982, at the Pacific Lutheran University campus, Tacoma WA. Registration is $5.00 and dinner is $7.50. Activities will include technical seminars, a flea market, commercial booths, an ARRL meeting, a repeater forum, a VHF tweak and tune clinic, prizes, raffles, and a loggers' breakfast. Talk-in on 147.88/.28. For more information, contact Grace Teitzel AD7S, 701 So. 120th, Tacoma WA 98444, or phone (206)-564-8347.

WILMINGTON DE
AUG 15

The seventh annual New Delmarva Hamfest will be held on Sunday, August 15, 1982, from 8:00 am to 4:00 pm at Gloryland Park, Bear DE (5 miles south of Wilmington). Admission is $2.25 in advance, $2.75 at the gate. Tailgating is $3.50. Limited tables will be available under the pavilion, but bring your own to be sure. Food and drinks will be available. First prize is an Atari® Home Video Game System. Talk-in on .52 and .13/.53. For more information and a map, send an SASE to Stephen Momot K3HBP, 14 Balsam Road, Wilmington DE 19804. For advance tickets, make checks payable to Delmarva Hamfest, Inc.

AMES IA
AUG 15

The Iowa 75 Meter Net will hold a picnic and swapfest on Sunday, August 15, 1982, at River Valley Park, Ames IA. A potluck meal will be held at 12:00 noon, with a program and prizes to follow. Talk-in on .16/.76. For further information, contact Lovelle J. Pederson WBØJFF, Hudson IA 50643.

LAFAYETTE IN
AUG 15

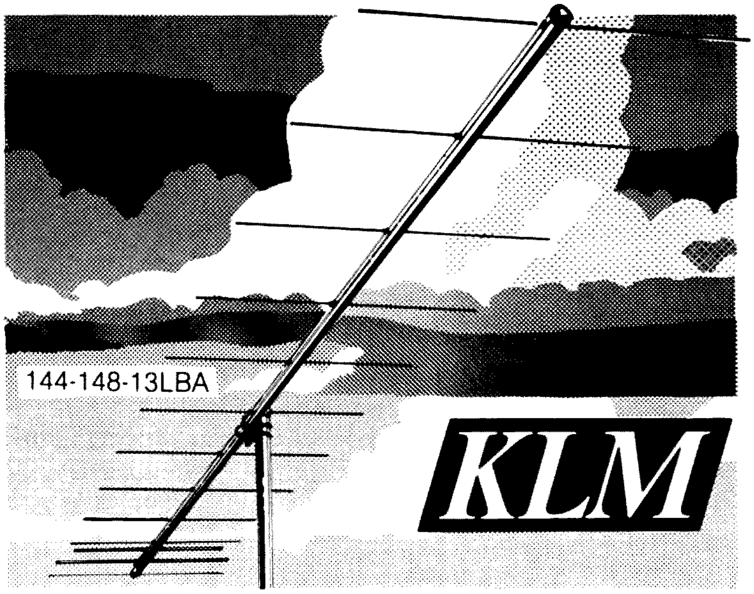
The Tippecanoe Amateur Radio Association will hold its 11th annual hamfest on Sunday, August 15, 1982, beginning at 7:00 am, at the Tippecanoe County Fairgrounds, Teal Road and 128th Street, Lafayette IN. Tickets are $3.00. Features will include a large flea market, dealers, fun, refreshments, and prizes. Talk-in on .13/.73 or .52. For advance tickets or additional information, write Lafayette Hamfest, Route 1, Box 63, West Point IN 47992.

TIOGA COUNTY PA
AUG 21

The Tioga County PA ARC 6th Annual Amateur Radio Hamfest will be held on Saturday, August 21, 1982, from 0800 to 1600 at a new location at Island Park, just off US Rte. 15, Blossburg PA. There will be a flea market, food, free camping, an auction, an H/T door prize, etc. Talk-in on .19/.79 and .52. For more information or advance tickets, write Tioga Co. ARC, PO Box 56, Mansfield PA 16933, or contact Paul Sando KC2AZ, 606 Reynolds Street, Elmira NY 14904 on .19/.79 or .96/.36.

DUNKIRK NY
AUG 21

The Northern Chautauqua Amateur Radio Club will hold the 4th annual Lake Erie International Hamfest on Saturday, August 21, 1982, at the Chautauqua County Fairgrounds, Dunkirk NY. There will plenty of outdoor and indoor flea-market space. Prizes will include an Icom IC-2A. Talk-in on 146.25/.85 and 146.07/.67. For more informa-



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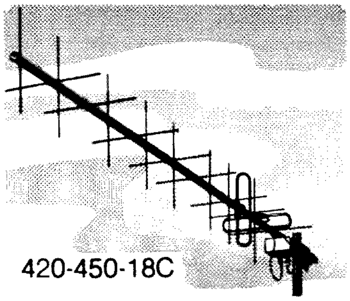

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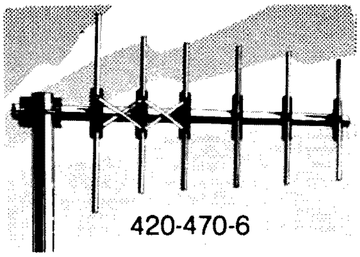

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OAKLAND NJ
AUG 21

The Ramapo Mountain Amateur Radio Club (WA2SNA) will hold its 6th annual flea market on August 21, 1982, at the Oakland American Legion Hall, 65 Oak Street, Oakland NJ, only 20 miles from the GW Bridge. Admission is $1.00; non-ham family members will be admitted free. Indoor tables are $6.50 and tailgating is $3.00. There will be a quality open kitchen, and door prizes, including an Icom IC-2AT, will be given away. Talk-in on 147.49/146.49 and .52. For additional information, contact Walt Zierenberg WD2AAI, 344 Union Avenue, Bloomingdale NJ 07403, or phone (201)-838-7565.

HUNTSVILLE AL
AUG 21-22

The Huntsville Hamfest will be held on Saturday and Sunday, August 21-22, 1982, at the Von Braun Civic Center in Huntsville AL. There is no admission charge. There will be prizes, exhibits, forums, an air-conditioned indoor flea market, and non-ham activities. Tours of the Alabama Space and Rocket Center are available for the family. A limited number of camping sites with hookups are available at the VBCC on a first-come, first-served basis. Flea-market tables are available for $4.00 a day. Talk-in on 3.965 and .34/.94. For more information, write Huntsville Hamfest, PO Box 4563, Huntsville AL 35802.

MARYSVILLE OH
AUG 21-22

The Union County Amateur Radio Club will hold the Marysville Hamfest on Saturday afternoon and all day Sunday, August 21-22, 1982, at the fairground in Marysville (near Columbus) OH. Admission is $2.00 in advance or $3.00 at the gate. Flea market space is $1.00. Food, beverages, and free overnight camping, movies, and popcorn will be available. Featured on Saturday night will be a free square dance (with a live band) followed by a big country breakfast available all night. Door prizes, ladies' programs, and ARRL, FCC, and MARS meetings will be featured on Sunday. Talk-in on 146.52 and 147.99/.39. For additional information, write UCARC, 13613 US 36, Marysville OH 43040, or call (513)-644-0468.

WENTZVILLE MO
AUG 22

The St. Charles Amateur Radio Club, Inc., will hold Hamfest 82 on August 22, 1982, at the Wentzville Community Center, Wentzville MO. Tickets in advance are $1.00 each or 4 for $3.00; at the door, they are $1.50 each or 4 for $5.00. Admission is $1.00 per car. There will be prizes, contests, a flea market, food, and air conditioned exhibitions buildings. For tickets, motel and camping information, prize lists, dealer reservations, etc., write SCARC Hamfest 82, c/o Mike McCrann WDØGSY, 25 Elm Street, St. Peters MO 63376.

ST. CHARLES IL
AUG 22

The Fox River Radio League will host the Illinois State ARRL Convention in conjunction with its annual hamfest, both to be held on August 22, 1982, from 8:00 am to 4:00 pm, at the Kane County Fairgrounds, St. Charles IL. Tickets are $2.00 in advance and $3.00 at the gate. For advance tickets, send an SASE to J. Dubeck KA9HQY, 1312

Bluebell Lane, Batavia IL 60510. There will be commercial exhibits, a flea market, contests, demonstrations, forums, prizes, and hot food. Talk-in on 146.94. Exhibitors, dealers, and vendors should contact G. R. Isely WD9GIG, 736 Fellows Street, St. Charles IL 60174.

ARGOS IN
AUG 29

The 7th annual Marshall County ARC Hamfest will be held on Sunday, August 29, 1982, from 8:00 am to 2:00 pm, at the Marshall County 4H Fairgrounds, Argos IN. Eight-foot tables are available for $3.00 and dealers will be able to set up at 6:00 am. Features will include commercial exhibits, a flea market, refreshments, and hourly drawings. Grand prize is $200. Talk-in on .07/.67, 146.52, and 222.9/224.5. For additional information or reservations, write MCARC, Box 151, Plymouth IN 46563.

FLINT MI
AUG 29

The Genesee County Radio Club, the Bay Area Amateur Radio Club, the Lapeer County Amateur Radio and Repeater Club, the Saginaw Valley Amateur Radio Association, and the Shiawassee Amateur Radio Association will hold the sixth annual Five County Swap-n-Shop on Sunday, August 29, 1982, from 8:00 am to 3:00 pm, at Bentley High School, 1150 Belsay Road, Flint MI. Tickets in advance are $2.00 per person; at the door, $3.00. Children under 12 will be admitted free. There will be a food concession, free parking, and prizes, including a first prize of a Ten-Tec 580 Delta and 280 power supply or $500 cash. Talk-in on 146.52 and 147.87/.27. For table reservations, contact Perry Baker WA8THK, 9055 Grand Blanc Road, Gaines MI 48436, or phone (313)-635-7287.

LEBANON TN
AUG 29

The Short Mountain Repeater Club will hold the Lebanon Hamfest on Sunday, August 29, 1982, at Cedars of Lebanon State Park, US Highway 231, Lebanon TN. There will be outside facilities only and exhibitors should bring their own tables. Food and drink will be available. Talk-in on 146.31/146.91. For further information, contact Mary Alice Fanning KA4GSB, 4936 Danby Drive, Nashville TN 37211.

SEWELL NJ
AUG 29

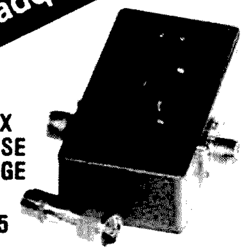
The Gloucester County Amateur Radio Club will hold its fourth annual GCARC Ham/Compfest on Sunday August 29, 1982, from 8:00 am to 3:00 pm at the Gloucester County College, Tanyard Road, Sewell NJ. Tickets are $2.00 in advance and $2.50 at the door. The tailgaters' and dealers' charge is $6.00 and includes one free admission. Doors will open at 7:00 am for setup. There will be speakers, seminars, contests, FCC exams, and prizes, including a Radio Shack TRS-80 computer and a Yaesu FT-208R. Talk-in on 146.52 and 147.78/.18. For more information, contact GCARC Hamfest Committee, PO Box 370, Pitman NJ 08017, or phone (609)-456-0500 or (609)-338-4841 (days) or (609)-629-2064 (evenings).

HARRISBURG PA
SEP 5

The Central Pennsylvania Repeater Association will hold the 9th annual Hamfest/Computerfest on September 5, 1982, beginning at 8:00 am, at the Harrisburg Farm Show parking lot, off the Route 81 Cameron Street exit. (Follow the

See List of Advertisers on page 114

Homebrew Headquarters



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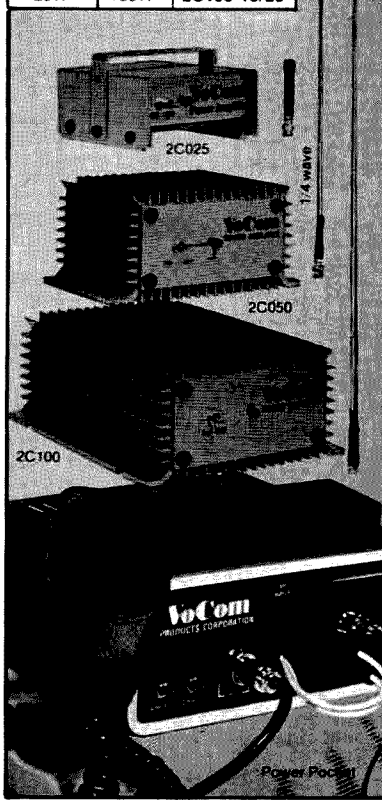
2W-5W	>50W	2C050-2W
2W-5W	>100W	2C100-2/25
10W	100W	2C100-10/25
25W	100W	2C100-2/25
25W	100W	2C100-10/25



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signs to the Farm Show building.) Registration is $3.00; sellers' 10-foot space, $5.00; tailgating, $1.00. Talk-in on 144.87/5.47, 146.16/.76, and .52. For more information or a map, contact Irvin Sanders K3IUY, RD #3, Box FA53, Harrisburg PA 17112, or phone (717)-469-2185.

HAMBURG NY
SEP 10-11

Ham-O-Rama '82 will be held on Friday and Saturday, September 10-11, 1982, at the Erie County Fairgrounds near Buffalo NY. Hours are 6:00 pm to 9:00 pm on Friday and 7:00 am to 5:00 pm on Saturday. Advance tickets are $3.50 (deadline: September 1st) and tickets at the gate will be $4.50. Children under 12 will be admitted free. The outside flea market is $3.00 per space and the inside flea market is $10.00 per space. Features will include new equipment displays, computers, technical programs, ladies' programs, and valuable awards. Talk-in on 146.31/.91. For advance tickets, send an SASE to Dave Baco WA2TVT, 130 Vegola Avenue, Cheektowago NY 14225.

UNIONTOWN PA
SEP 11

The Uniontown Amateur Radio Club will hold its 33rd annual gabfest on Saturday, September 11, 1982, on the club grounds located on the Old Pittsburgh Road, just off Route 51 and the 119 bypass, Uniontown PA. The pre-registration fee is $2.00 each or 3 for $5.00. There will be free parking, free coffee, and free swap and shop setups with registration. Prizes will be awarded, including a first prize of a Ten-Tec Argosy 525 HF. Featured will be a DX contest, demonstrations, and refreshments. Talk-in on 147.045/.645, 144.57/145.17 and 146.52/.52. For further information, contact UARC Gabfest Committee, c/o John T. Cermak WB3DOO, PO Box 433, Republic PA 15475, or phone (412)-246-2870.

AUGUSTA NJ
SEP 11

The Sussex County Amateur Radio Club will hold its fourth annual SCARC '82 hamfest on Saturday, September 11, 1982, at the Sussex County Farm and Horse Show grounds, Plains Road off Rte. 206, Augusta NJ, just north of Newton. Pre-registration for outdoor flea-market sellers is $4.00; at the gate, $5.00. Pre-registration for indoor flea-market sellers is $5.00; at the gate, $6.00. Other registration is $2.00. There will be door prizes and acres of free parking. Talk-in on 147.90/.30 and 146.52. For additional information or pre-registration, write Sussex County Amateur Radio Club, PO Box 11, Newton NJ 07860, or Lloyd Buchholtz WA2LHX, 10 Black Oak Drive, Vernon NJ 07462.

MARION IN
SEP 11

The Grant County Amateur Radio Club Hamfest will be held on Saturday, September 11, 1982, at McCarthy Hall, Marion IN, from 8:00 am until 4:30 pm. Admission is $2.00 in advance and $3.00 at the gate. There will be good home cooking, hourly drawings, and major prizes. Talk-in on 146.19/.79 and 146.52. For more information or tickets, send an SASE to Beecher Waters WB9YHF, RR #1, Box 357, Converse IN 46919.

MELBOURNE FL
SEP 11-12

The Platinum Coast Amateur Radio Society will hold its 17th annual hamfest and indoor swap-and-shop flea market on September 11-12, 1982, at the Melbourne Auditorium, Melbourne FL. Admission is $3.00 in advance and $4.00 at the door. Swap tables are $10.00 for one day and $15.00 for both days. There will be unlimited free parking, a tail-gate area, air-conditioned swap and exhibit area, awards, forums, and meetings. Talk-in on .25/.85 and .52/.52. For reservations, tables, and information, write PCARS, PO Box 1004, Melbourne FL 32901, or call (305)-245-5116.

BUTLER PA
SEP 12

The Butler County Amateur Radio Association will hold its annual hamfest on Sunday, September 12, 1982, from 9:00 am to 4:00 pm, at the Butler Farmshow Grounds at Roe Airport, Butler PA. Fly-in at Butler Farmshow Airport. Admission is a $1.00 donation and children under 12 will be admitted free. Overnight campers are welcome and food and refreshments will be available. There will be an indoor flea market (vendor space will be $3.00 per 8-foot table), a free outside flea market, free parking (including for the handicapped), and prizes, including a Kenwood TS-830S HF transceiver. Talk-in on 147.96/.36, .52, and 147.84/.24. For additional information, contact Leighton Fennell, Crestmont Drive, RD 6, Butler PA 16001, or phone (412)-586-9822.

WILLIMANTIC CT
SEP 12

The Natchaug Amateur Radio Association will hold a giant flea market on Sunday, September 12, 1982, from 9:00 am until 4:00 pm, at the Elks home, off Rtes. 32 and 6, Willimantic CT. Tables may be reserved in advance for $5.00 until September 1st; after that date, they will be $7.00 at the door. Admission is $1.00. There will be free parking, as well as raffles and door prizes. Talk-in on 147.30 and 147.90/.50. For further information, contact Clifton Pease KA1HYW, 268 Main Street, Willimantic CT 06226, or phone (203)-456-1432 after 4:00 pm.

CARTERVILLE IL
SEP 12

The Shawnee Amateur Radio Association will hold its 26th hamfest, SARAFEST '82, on Sunday, September 12, 1982, at John A. Logan College, Highway 13, Carterville IL. Admission is $2.00 in advance and $3.00 at the door. There will be an air-conditioned flea market, forums, computers, refreshments, contests, and prizes, including a first prize choice of a Kenwood 130S HF transceiver, a microwave oven, an RCA color TV, or an automatic dishwasher. Talk-in on 146.25/.85, 146.52, and 3.925. For further information, contact William May KB9QY, 800 Hilldale Avenue, Herrin IL 62948, or phone (618)-942-2511 days.

GRAND RAPIDS MI
SEP 18

The Grand Rapids Amateur Radio Association, Inc., will hold its annual Swap and Shop on Saturday, September 18, 1982, at the Hudsonville Fairgrounds. There will be prizes and dealers, with an indoor sales area and an outdoor trunk swap area. Gates will open at 8:00 am for both swappers and the public. Talk-in on 146.16/.76. For more information, write Grand Rapids Amateur Radio Association, Inc., PO Box 1248, Grand Rapids MI 49501.

PEORIA IL
SEP 18-19

The Peoria Area Amateur Radio Club will hold the Peoria Superfest '82 on September 18-19, 1982, at the Exposition Gardens, W. Northmoor Road, Peoria IL. The gate opens at 6:00 am; the commercial building at 9:00 am. Admission is $3.00 in advance or $4.00 at the door. Activities include forums, amateur radio and computer displays, a free flea market, and, on Saturday evening, an informal get-together at the Heritage House Smorgasbord. At the hamfest site, there will be free movies Saturday night. Full camping facilities are available, as well as a Sunday bus to Northwoods Mall for the ladies. Talk-in on 146.16/.76. For more information, contact Charles W. Kuhn WD9EGW, PAARC Director, 7005 N. Tobi Lane, Peoria IL 61614.

MONTGOMERY AL
SEP 19

The Central Alabama Amateur Radio Association will hold its 5th annual hamfest on Sunday, September 19, 1982, at the Civic Center, downtown Montgomery AL. There will be free admission, free parking, and 22,000 square feet of air-conditioned activities, including a flea market. Setup will be at 0600, doors will be open from 0800 to 1500, and a prize drawing will be held at 1400 CDST. Restaurants and motel accommodations are located within a short walk of the Civic Center and refreshments will be available in the Civic Center. Talk-in on 146.04/.64, 146.31/.91, 147.78/.18, or 147.045/±600T. For further information or market reservations, write Hamfest Committee, 2141 Edinburgh Drive, Montgomery AL 36116, or call Phil at (205)-272-7980 evenings.

VENICE OH
SEP 19

The Forty-Fifth Annual Cincinnati Hamfest will be held on Sunday, September 19, 1962, at Stricker's Grove, State Route 128, Venice (Ross) OH. Admission and prize ticket, $5.00. There will be exhibits and booths, prizes, a flea market (radio-related products only), a hidden transmitter hunt, and an air show. Food and refreshments will be available. For further information, write Lillian Abbott K8CKI, 317 Greenwell Road, Cincinnati OH 45238.

NEW KENSINGTON PA
SEP 19

The Skyview Radio Society will hold its annual hamfest on Sunday, September 19, 1982, from noon until 4:00 pm, at the club grounds on Turkey Ridge Road, New Kensington PA. Registration fee is $2.00; vendors, $4.00. There will be awards. Talk-in on .04/.64 and .52.

NEWTOWN CT
SEP 19

The Candlewood Amateur Radio Association will hold a flea market and auction on Sunday, September 19, 1982, rain or shine, at the Essex House, Rte. 6, exit 8 off I-84, Newtown CT, from 10:00 am to 4:00 pm. Admission fee of $1.00 includes one door prize chance. Tables are $8.50. Featured will be an equipment raffle of a TR-2500 handie-talkie, dealers, and a magic show for the kids. Refreshments will be available. Talk-in on 147.72/.12. For advance table reservations, write CARA, PO Box 188, Brookfield Center CT 06805. For more information, call George WB2THN at (914)-533-2758, Ken KA1GDS at (203)-744-6953, or George AF1U at (203)-438 0549.

ELMIRA NY
SEP 25

The Elmira Amateur Radio Association will hold the seventh annual Elmira International Hamfest on September 25, 1982, at the Chemung County Fairgrounds. Breakfast will be available for several hours after the gates open at 6:00 am. Advance tickets are $2.00 and tickets at the gate are $3.00. Featured will be tech talks, a free flea market, dealer displays, and prizes, including a grand prize of an Icom IC-730. Friday night camping will be available on a limited basis at the fairgrounds and lunch will be available starting at 11:00 am on Saturday. Talk-in on 147.96/.36, 146.10/.70, and 146.52. For advance tickets, write John Breese, 340 West Avenue, Horseheads NY 14845.

GAINESVILLE GA
SEP 26

The 9th annual Lanierland ARC Hamfest will be held on September 26, 1982, beginning at 9:00 am, in the Holiday Inn, Gainesville GA. There will be free tables and an inside display area for dealers and distributors (doors will open at 8:00 am for dealer setups). Prize tickets are $1.00 each or 6 for $5.00. Food and drink will be available, as well as a large parking lot for a free flea market. A boat anchor auction will be held and all activities and facilities will be free. Talk-in on 146.07.67. For information and free space to dealers, contact Phil Loveless KC4UC, 3574 Thompson Bend, Gainesville GA 30506, or phone (404)-532-9160.

YONKERS NY
OCT 3

The Yonkers Amateur Radio Club will hold its electronics fair and flea market on Sunday, October 3, 1982, from 9:00 am to 5:00 pm, rain or shine, at Yonkers Municipal Parking Garage, corner of Nepperhan Avenue and New Main Street. Admission is $2.00 each; children under 12 will be admitted free. Sellers' spaces are $6.00 (bring your own table) and include one admittance. Gates will be open to sellers at 8:00 am. There will be live demonstrations, hourly prizes, an auction, free parking, refreshments, and unlimited free coffee all day. Talk-in on 146.265/146.853, .52, or CB channel 4. For further information, write YARC, 53 Hayward Street, Yonkers NY 10704, or phone (914)-969-1053.

CHELSEA MA
OCT 17

The 19-79 Repeater Association of Chelsea MA will hold its annual flea market on Sunday, October 17, 1982, from 11:00 am to 4:00 pm (sellers admitted at 10:00 am), at the Beachmont VFW Post, 150 Bennington Street, Revere MA. Admission is $1.00. Sellers' tables are $6.00 in advance and $8.00 at the door, if available. Talk-in on .19/.79 and .52. For table reservations, send a check to 19-79 Repeater Association, PO Box 171, Chelsea MA 02150.

NORTH HAVEN CT
NOV 7

The Southcentral Connecticut Amateur Radio Association's (SCARA's) third annual electronics flea market will be held on Sunday, November 7, 1982, indoors at the North Haven Recreation Center on Linsley Street in North Haven CT. Regular admission is $1.25; children under 12 with an adult will be admitted free. Sellers' spaces are $6.00. The best spaces will be assigned first. A limited number of free tables will be provided to the first reservations received. When those tables are gone, space will be available for selling from the floor or from your own table. Food will be available. Sellers may set up at 8:00 am, and walk-ins will be admitted from 9:00 until 3:00. For reservations, send check or money order payable to "SCARA" to Ed Goldberg WA1ZZO, 433 Ellsworth Avenue, New Haven CT 06511. Include an SASE for confirmation.

HAM HELP

I need information on an Abbott TR-4 and an Abbott TR-4B. I would also like information on Navy type CRI-43044, a unit of Model TBY-8 and Model TBY-7.

Craig Renler
7418 Lesada Dr.
Baltimore MD 21207

I need operating/maintenance manuals for the following equipment: Yaesu FT-707; Astro 150A; Hewlett-Packard Model 122AR oscilloscope; Anton Elect. Corp. TS-505 D/U VTVM; and Shallcross ZM-3/U capacitance analyzer.

I will buy originals or pay for copying.

H. Hutchison
N4GQE, HP1XHH, N4GQE/YSI
USMILGP, El Salvador
APO MI 34023

I am looking for an instruction or technical manual for an old BC 211M frequency meter as well as for a CW filter for a Galaxy GI 550A transceiver. I will pay.

Bob Currier KA5ETF
5529 Marblehead
Jackson MS 39211

I would appreciate any information on a frequency counter which could be used with the Collins 51S-1 and 51J-4 receivers. I am also looking for anyone who has modified a 51J-4 to receive FM or who may be able to supply a suitable modification.

Clano Strachan C6ANI
PO Box N4106
Nassau NP
Bahamas

I am in need of a schematic or manual for an RCA Institute scope. Tubes are 1V2, 6BL8, 6D10, 6X4WA, (2) 12AU7s, and WX5078 P1. I will pay for the information.

J. W. Hopson W4AEM
959 Overhill Drive
Alexander City AL 35010

I need the QSL cards of those who are Church of Christ hams for the 1983 Church of Christ *Callbook* I am putting together.

Ray Hawk NW4L
1461 East Chester
Jackson TN 38301

I would like to purchase original manuals for the Hickok Model 1805A oscilloscope and Tektronix Model N preamp.

Eiichi Takarada
1423 Vassar Rd.
Rockford IL 61103

Would the fellow who sold me the Comco business-band handle-talkie at the Dayton Hamvention please contact me. I would like to buy the Model 43 Teletype machine that you had shown me. Please call collect after 6:00 pm: (614)-922-2652.

Daniel Durgin KA1AFJ/8
121 Lake St.
Uhrichsville OH 44883

I would like to hear from anyone who has a cure for the S-meter drift problem in the Tempo 1 transceiver.

Dick Roux N1AED
25 Greenfield Dr.
Merrimack NH 03054

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RG11U 96% shield, 75-ohm mil spec .... 25¢/ft.
RG6U 96% shield, mil spec .... $27.95/100 ft. or 31¢/ft.
RG6A/U double shield, 75-ohm .... 25¢/ft.
RG58AU stranded mil spec .... 12¢/ft.
RG58 mil spec. 96% shield .... 11¢/ft

LOW LOSS FOAM DIELECTRIC
RG8X 95% shield (black, white or gray).....$14.95/100 ft. 17¢/ft.
RG8U 80% shield .... 18¢/ft.
RG58U 80% shield .... 07¢/ft.
RG58U 95% shield .... 10¢/ft.
RG59U 100% foil shield, TV type........$7/100 ft. 10¢/ft.
RG8U 97% shield 11 ga. (equiv. Belden 8214)......31¢/ft.

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PL-259 & SO-239 .... 10/$5.89
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PL-258 Double Female Connector .... 98¢
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Reducer UG-175 or 176 .... 10/$1.99
UG-255 (PL-259 to BNC) $3.50
Elbow (M359) $1.79
F59A (TV type) .... 10/$2.15
UG 21D/U Amphenol Type N Male for RG8.........$3.00
BNC UG88C/U, male $1.25
3/16 inch Mike Plug for Collins etc..................$1.25
UG273 BNC to PL-259 .... $3.00

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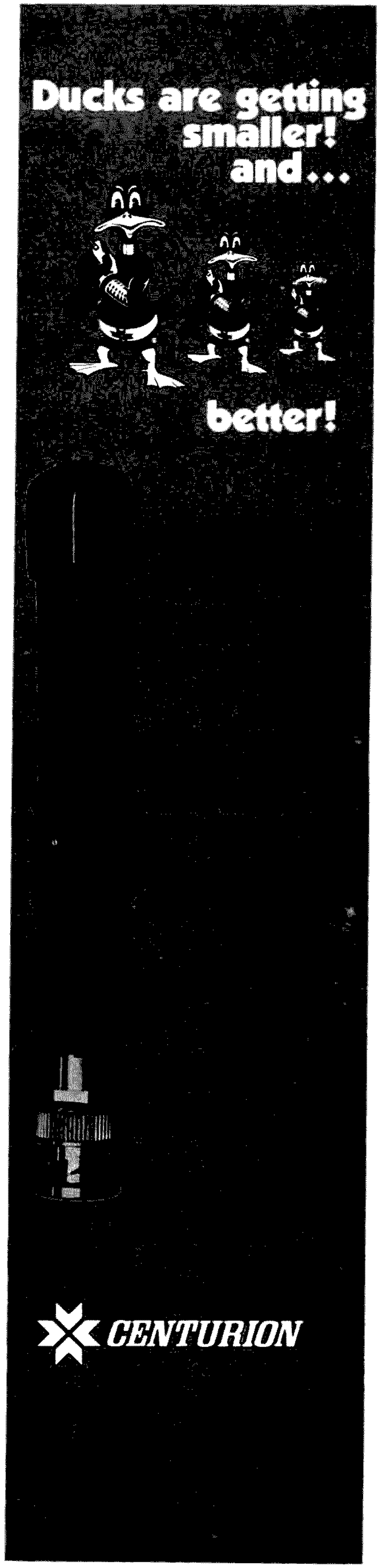

✓See List of Advertisers on page 114

D. N. Ellis WA2FPT
RD 1, Box 108A
Ulster Park NY 12487

Confessions of a Counter Evolutionary

—the best circuit yet?

Editor's Note: The LSI Computer Systems LS7030 counter chip used in this project is available from Belco Electronics, 43 South 49th Ave., Bellwood IL 60104, for $12.75 plus shipping. Next month we'll bring you the conclusion of WA2FPT's discussion.

As many of you may have done already, I had vowed never again to be lured into reading another frequency counter article, one more of those ubiquitous "counter updates," or even another of the scores of ads splashed over the pages of ham magazines. I was certain that I had been told more than I ever wanted to know about counters.

Why have I yielded to temptation (lured by the possibility of publication) and become a part of this ever-increasing problem? I confess! The truth is, I was seduced by an LSI counter chip, the LS7030 from LSI Computer Systems, Inc. This little beauty measures a full 40 (pins, that is) and is an 8-decade, multiplexed up counter. It counts directly to 5 MHz, is CMOS and TTL-voltage compatible, and has BCD *and* 7-segment multiplexed display outputs. It also employs and enjoys leading-zero blanking and very low power consumption. A real gem!

Even with all this on a chip, what would cause anyone, much less an impatient convenience-seeker like me, to take the trouble to design a frequency counter when there are a host of appetizing kits well within the one "centi-buck" range? I'll answer this in terms of the WA2FPT 7030 Universal Counter's features:

- 10-MHz oven-controlled crystal oscillator
- Full 8-digit resolution with no least-significant-digit bobble (no ± 1 count uncertainty)
- Four selectable timebase gate times: .01, .1, 1, and 10 seconds
- Hi-Z dc to 5-MHz preamp input
- Lo-Z 5-500-MHz preamp prescaler input
- Kilohertz, megahertz readout with automatic decimal point placement
- Period measurement with 20-period average, with direct readout in μsec to 99,999,999 (equivalent to .01 Hz)
- Events mode (totalizing) with manual front-panel controls and remote rear-panel control inputs
- Separate power regulators for the master oscillator, front ends, displays, and counter
- 10-MHz TTL test output and 6 additional buffered CMOS oscillator timebase signal outputs from 10 Hz to 1 MHz
- 25-pin E1A RS-232C type monitor jack for future remote-data acquisition and control
- Push-button front-panel operation with LED indicators—no rotary switches
- 90% wire-wrapped noncritical construction

If these features are interesting, then read on to see how to build this deluxe counter for truly a fraction of the cost of a commercial equivalent.

Before we get tangled up in our wire-wrapping, here's a short review for those who don't live and breathe digital counters. If you are one of those fortunate few

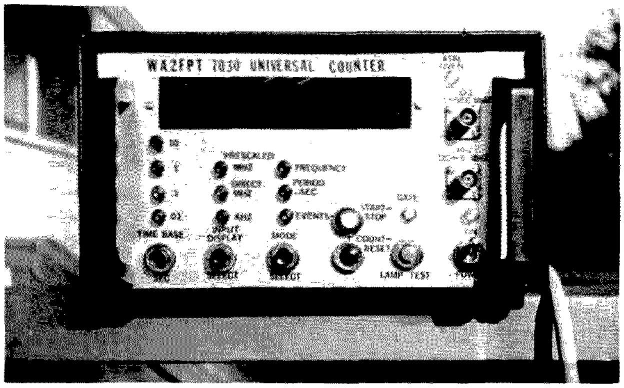

Photo A. Push-button selection is used to control the 7030 Universal Counter.

who do, then skip this short primer.

Elementary Counting

The simplest form of a counter is one that only totalizes incoming events. Fig. 2 shows three basic functional parts. The input conditioner transforms a physical event into electrical signals that are used to increment the second part. The decade counter counts from 0 to 9 and provides a carry-out to the next digit counter. The third vital element is the indicator. It decodes and converts the outputs of the decade counter to a visual presentation hopefully useful to some observer.

Fig. 3(a) shows a simple frequency *counter*. To count frequency, a "window" or "gate" must open and close for a specified time interval to give counts per second, or even "furlongs per fortnight." Any number of something counted in a unit of time is an expression of frequency. Simple enough.

Two extra items are needed, however, to make a frequency counter useful: a reset and a holding or loading device. The reset is needed to ensure that the counter begins counting from zero at the beginning of the gate time. The loading device retains the value of the last count and then updates the display with that value after the counting window has shut. This "new improved" simple frequency counter is shown in Fig. 3(b).

Period counters measure the time between events. Often period measurement is used to accurately calculate very low frequencies. This becomes necessary as the value of the frequency approaches the frequency of the counting gate. To appreciate the added resolution available for such low-frequency measurement, suppose you wanted to measure the ac line frequency. It's 60 Hz, right? Well, if you want to measure it to four significant digits, you would need a gate time of at least 100 seconds (to give a 60.00-Hz display)—a long time to wait. A simple period counter could enable us to obtain the required resolution by using our "unknown" line frequency (suitably conditioned for our digital circuitry) as the gate for a much higher *known* frequency, say 10 kHz (often readily available in timebase oscillator divider chains).

Suppose these 10-kHz pulses are then counted and displayed as before. Fig. 4 shows how the 60-Hz signal gives a count of 1668. This value is .01668 seconds, the period of the line frequency. As frequency = 1/period, and vice-versa, our 4-place readout is readily converted to frequency by using a calculator to divide 1 by 0.01668. Answer: 59.95 Hz. All we did to get this handy period counter was to interchange the "unknown" signal and the gate time. There is no waiting 100 seconds, either, as the display could normally be updated about 60 times per second.

Now that you're all enlightened, let's be counter productive and get back to the real counter.

Master Oscillator

The evolution and progression of the WA2FPT Universal Counter will be covered in pieces by looking in some detail at each of the Fig. 1 blocks.

The beating heart of any counter, the master oscillator, will be described first. The one shown in Fig. 5 is based on a 10-MHz AT high accuracy series-mode quartz crystal matched to its 85° oven. Both the crystal and oven were purchased from International Crystal Manufacturing Co., 10 North Lee, Oklahoma City OK 73102. The bucks spent here or on a similar affair will be well worth it to provide stability and accuracy for your counting machine.

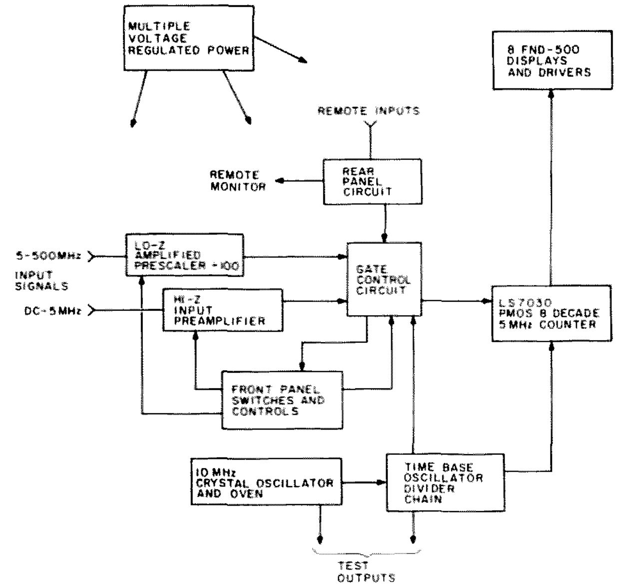

Fig. 1. Block diagram.

The oscillator itself is a 5400 TTL quad 2-input gate. A 7400 could be used, but the "Milspec" 5400 in its ceramic package was also chosen for stability (and because I had one!). The voltage regulation for the oscillator is provided by a dedicated 723 wired to give a 5-6-volt, 150-mA output. The oscillator, along with a 74LS90 decade divider, draws about 130 mA, which provides a desirably constant load. The variable capacitor serves as a coarse frequency trimmer. Except for the frequency and the 723 portion, this circuit is the same as the one WA1FUE described in his excellent counter article in the December, 1976, issue of *73 Magazine*.

I had hoped originally to build the 5400 into the oven, but soon found there wasn't enough room. Because there is a double oven, there is room for a trimmer cap as well as the crystal inside. The oven plugs into an octal socket mounted on a small aluminum minibox *containing* the 5400, the 723, and the rest of the oscillator components.

An extremely simple printed circuit board layout is shown in Fig. 6(a). This full-size board is copper-clad epoxy glass with 0.1" centered holes (Vector 169P44C1 or equivalent).

Keeping the trimmer capacitor in the oven solves a significant source of oscillator variance due to trimmer cap temperature drift. As the oven heats up to 85° C, the trimmer heats up, and, as the oven stabilizes, so does the trimmer. As you might imagine, a decent mica or ceramic trimmer (25-75 pF or so) is required here. The oven cover may have to be left off, depend-

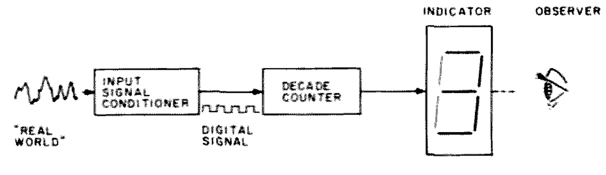

Fig. 2. Simple events counter.

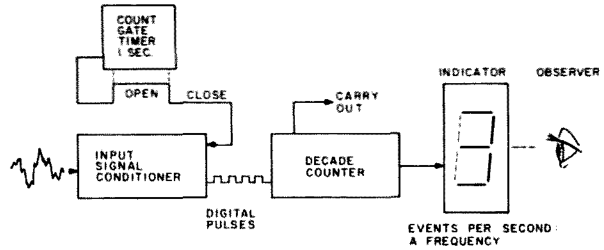

Fig. 3(a). Basic frequency counter.

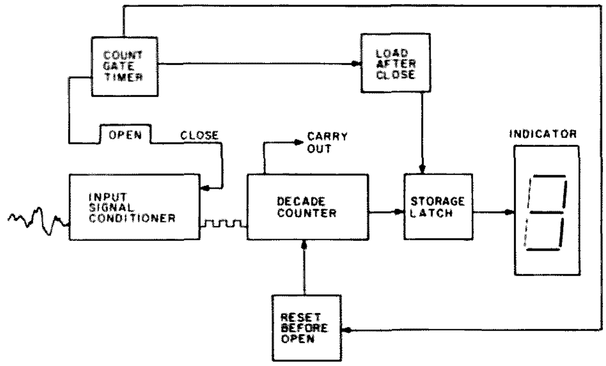

Fig. 3(b). Improved simple frequency counter.

ing on the size and/or accessibility of the capacitor's adjustment screw.

In addition to the trimmer capacitor, there is a fine frequency adjustment. The 723 has a ten-turn 500-Ohm pot to give controlled millivolt level changes in the 5-6-volt range of the 723 output. This allows minute tweaking of the output frequency. A screwdriver access hole for the trimmer pot screw was planned and cut in the minibox housing and through the counter chassis. Binding posts were provided on top of the minibox near the plug-in crystal oven for monitoring the output of the 723. This, with a rear-panel BNC 10-MHz test jack, allows convenient access to long-term oscillator drift and aging data versus voltage, if there should be a need for such logging. The 74LS90 is wired to produce a symmetrical 1-MHz square wave, and miniature coax, RG-174 or its equal, routes this signal to pin 22 of a 44-pin edge connector on the main counter board.

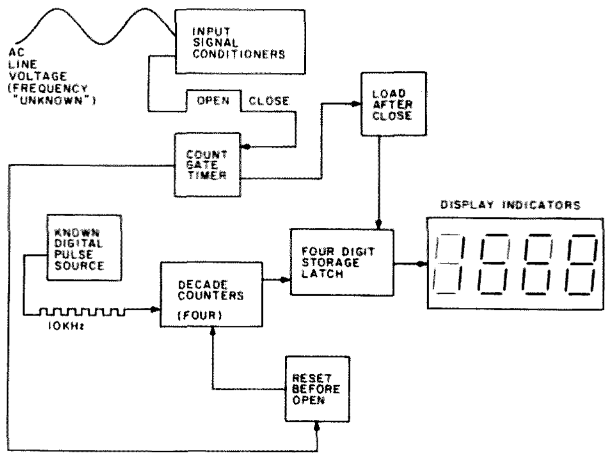

Fig. 4. Period counter example.

Timebase Oscillator Dividers

The timebase oscillator dividers (TBOD) are mounted on wire-wrapped sockets on the main board of the counter—a 4.5" × 6" Vector 3662. The wiring for the TBOD is shown in Fig. 7. ICs 3, 8, 9, and 10 are 74C90s, while ICs 2, 5, and 6 are 4029 types.

The 74C90 devices are wired as decade dividers, with the output of the ÷5 portion, pin 11, fed into the input of the ÷2 section at pin 14. The 4029 is a dual-mode (decade or binary) up-down (user-selectable) counter in a 16-pin package. In this application it is wired as a decade up counter. There is no reason why 74C90s could not be used exclusively as they are cheaper to buy and use cheaper sockets. I used both chips because I had a few of each on hand.

The TBOD, as is customary in electronic counters, provides a number of important signals that are distributed throughout the machine. The signal frequency and its destination, together with a brief description, comprise the list of pulses picked off the IC chain (see Table 1). As long as the master oscillator runs, these signals are present.

Display

The eight seven-segment common-cathode displays in this counter are FND 500 .5" right-hand decimal-point devices. They can be purchased for under a dollar apiece from many sources and are entirely adequate.

The displays are multiplexed, which is a fancy way of saying that one digit is lit at a time. Our persistence of vision will see all eight digits lit, however, if the scanning rate is fast enough. This technique greatly reduces power supply drain and just happens to be built into the 7030 chip. The 7030 implements this feature with an on-board digit-scanning generator that strobes the digits sequentially from left to right (digits 8 to 1) when a pulsing signal is input to pin 39. There is also a built-in digit-scanner oscillator requiring only an external capacitor between pins 39 and 40. Since the TBOD has a plentiful supply of signals, a 1-kHz signal was used for scanning, and it works well. A scan reset is needed, according to the 7030 data sheet, to avoid display damage and for leading-zero blanking. I used a 20-Hz signal, allowing 50 display scans before a reset blanks the display.

The result is a nice bright display with an almost imperceptible flicker. Faster scanning rates are possible, and faster resets will produce no visible flicker whatsoever, but the brightness will suffer. This is because the digit strobe duty cycle is only about 12%. The scanning-oscillator signal is divided into eight such sequential strobes.

These strobes, as MOS outputs, are not sufficient to drive display diodes directly. Instead, the strobes are sent to 75492 hex MOS-to-LED drivers, which have six drivers per package, each capable of sinking 250 mA.

The seven-segment information is similarly amplified by 75491s, which are quad MOS-to-LED segment drivers. The seven segments, labeled a–g, plus the decimal point, fully use two 75491 chips.

In a multiplexed display system, the seven-segment outputs are "daisy-chained" to all digits. That is, all the "a" segments for all the digits are wired together, and the "b" segments are wired to each other, and so on.

As the seven-segment information is sent to all those diodes, only the di-

odes in the digit that receives a strobe will light up.

A simplified pseudo-schematic could help illustrate this in Fig. 8. Assume that the three digits 8, 7, and 6 all have ones to be displayed. The active segment outputs from the 75491 are the "b" and "c" segments that will give a one when each digit is strobed. To forward bias the LEDs, the high pulse to the 75492 is inverted to a low, which will provide the proper bias solely for digit 8. The next strobe will activate digit 7 (turning off 8), and the next, digit 6 (turning off 7). All seven-segment information is synchronized by the digit strobes, and we see the result arranged as numbers 0–9. When the scan reset occurs, the scan oscillator restarts at position 8, the most significant digit.

One of the many economies resulting from display multiplexing is the elimination of the usual current-limiting resistors. They are not needed here because the scanning rate is sufficient to keep the average current through the LEDs at an acceptable level. A "direct drive" 8-digit display with decimal points could require 8 latches, 8 decoder drivers, and 64 current-limiting resistors. The overall brightness of the display may be varied by changing the supply voltage to the 75491 and 75492 devices and the scan rate.

The FND 500s are not as efficient as they are inexpensive, and the overall brightness was enhanced by using an 8-volt regulator, an LM340T-8, solely for the panel LEDs and the eight seven-segment display drivers.

If you decide to use different displays in your version, you will probably want to experiment a little with different voltages and scanning rates to optimize the display presentation to your liking. Fig. 9 shows the complete 8-digit wiring used in this counter.

The 7030 has a lamp-test input (pin 38) that, when brought high (+5 volts), will light all segments of all eight digits, showing all 8s. I couldn't resist putting a "lamp-test" push-button on the front panel for that purpose. The circuit used, though, does provide a useful function, because a counter overflow condition is also incorporated.

The 7030 has its three most significant decade overflow outputs for digits 8, 7, and 6 brought out to pins 14, 15, and 16, respectively, of IC1. Because this machine is an 8-digit counter, it made sense to use the eighth decade overflow output from pin 14 to set the overflow input latch at pin 13 of the 7030. An internal flip-flop holds the overflow indication until a counter reset (not a scan reset) occurs. As the overflow output becomes active, it sets the 4013 IC31 in the lamp-test circuit, causing a

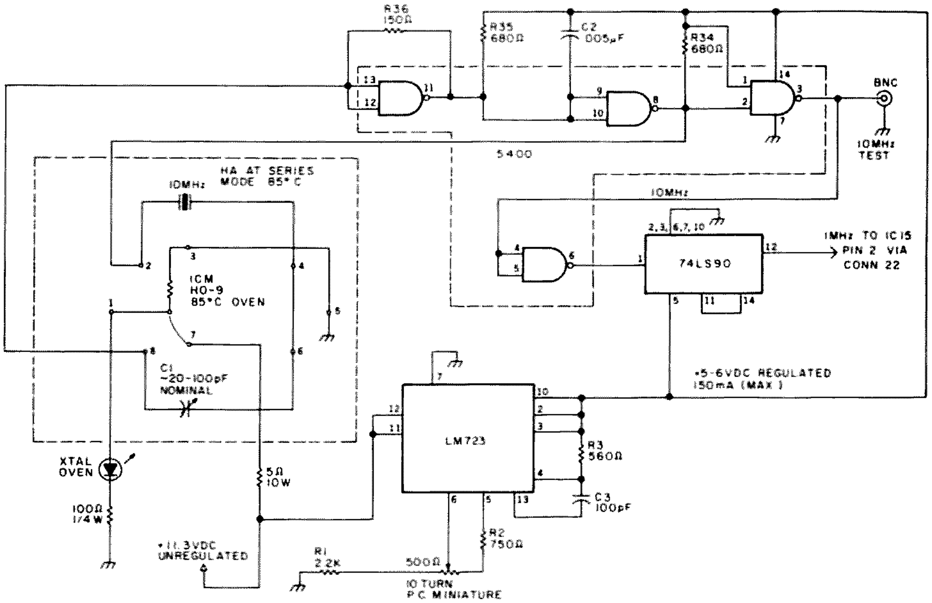

Fig. 5. Master oscillator.

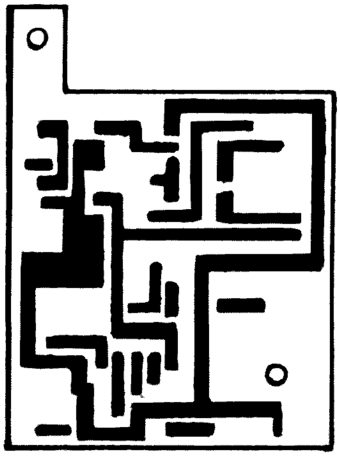

Fig. 6(a). Master oscillator PC layout.

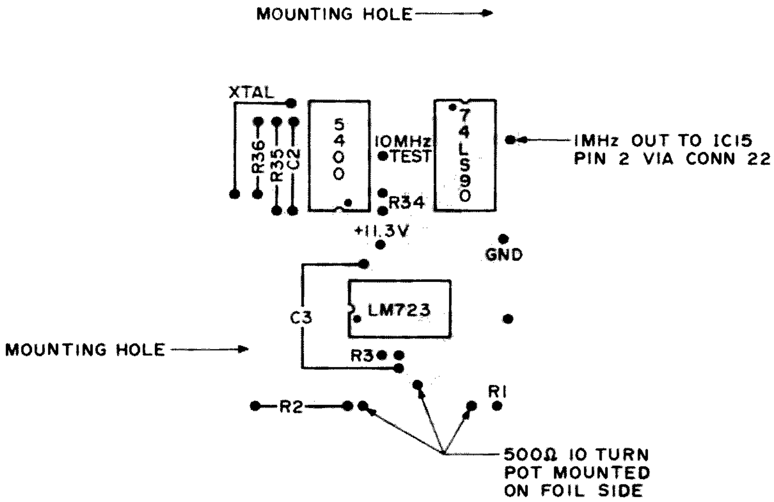

Fig. 6(b). Parts placement for master oscillator board.

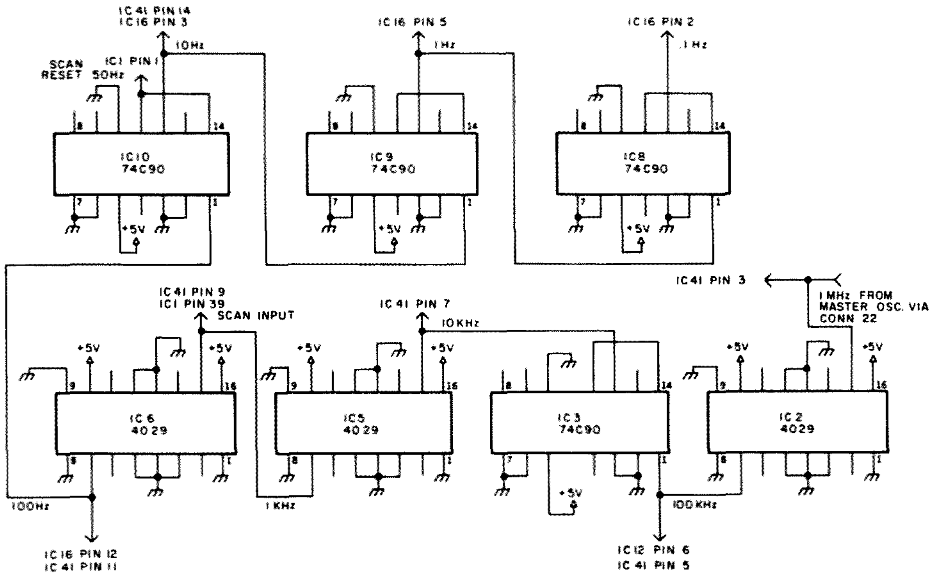

Fig. 7. Timebase oscillator divider chain.

display of all 8s. They will remain lit until the counter is reset. Should the overflow input be left unused, the counter display will "wrap around" to zero after 99,999,999 and begin counting again from zero. This probably wouldn't occur in frequency counting, but could be an important consideration in events totalizing.

The manual lamp-test push-button (as shown in Fig. 10) is connected to activate the lamp-test flip-flop (IC31) via the direct set input. An unused 74C00 gate is used as an inverter. The overflow latch output is sent to the data input, and when clocked by a convenient source (1 kHz here), it also activates the lamp test, separately from the previously-described manual operation.

This arrangement is only one of several possibilities, but it uses leftover gates and flip-flops. Other unused gates don't appear in the schematic, but have their inputs grounded. The CMOS doesn't like loose ends.

Counter Tactics

Now that the timebase and display have been described, let's journey into the bowels of the counter.

The counter has two inputs, in contrast to the simple demonstration example. These two inputs are shown with the gate controls in Fig. 11(a). The two input sources are conditioned to provide CMOS-compatible square waves that swing from almost ground to the supply voltage of +5 volts.

The PM line controls which of the two input signals is allowed through the remaining two input NAND gates of IC14. These comprise a 2-to-1 data selector; that is, the condition (GND or +5) of the PM line always enables one or the other, but not both, of the signals through the gates to finally output the signal to be counted on pin 6 of IC14. A low on the input of a NAND will keep its output high. Because of this, IC14 A and C will be controlled by the PM line with the aid of IC14 D, an inverter made from the remaining NAND gate. As the signal will suffer two inversions, whether through the path of IC14 C and B, or A and B, the output at pin 6 is logically identical to either of the selected inputs.

The input then goes to a 74C90, whose ÷10 output is used solely in the period mode, and then into a 74C157. The 74C157 is a device containing four 2-to-1 multiplexers that operate logically the same as the one formed by IC14. The 74C157 uses a single select line (pin 1) to route one of the two inputs for passage at a time. The two inputs A and B are shown for each of the four 2-to-1 multiplexers native to a 74C157. A high (or 1) level (~5 volts) on the select input chooses the B input for transmission, while a low (or 0) level (~GND) lets the A input pass.

Fig. 11(b) shows the gate synchronizer lifted out of the rest of the schematic for clarity. The input to the counter will *not* be the incoming frequency when the P (for Period) line is at a 1 level. For events totalizing and for frequency mode, the signal pulses are sent to a NAND gate (pin 4) and to the clock input (pin 3) of IC13, a 74C74 D-type flip-flop. The purpose of the other half of IC13 will be explained shortly.

Notice how the output of IC13, pin 5, is combined with the clock signal in the NAND gate accompanying pins 4, 5, and 6. This is the circuit that synchronizes the timebase with the input to eliminate the least-significant-digit jitter. The flip-flop "remembers" the timebase input at the pin 2 data input and transfers the rise or fall of the timebase signal to the Q output *only when clocked by the incoming event.* This timebase output enables the NAND gate, and the resulting output at pin 6 is the integer-valued pulse train that is counted by the 7030 at pin 32. The 7030 counts on the negative edge of the incoming signal, so NAND provides exactly the right combination of input and output levels. When the timebase at pin 5 falls, the output of the NAND goes high, shutting the gate to the 7030 counter.

This is an example of the

Signal	Source	Destination	Comments
1 MHz	Master oscillator Edge connector pin 22	IC41 pin 3	CMOS buffer
		IC2 pin 15	Input to TBOD
100 kHz	IC2 pin 7	IC3 pin 1	TBOD
		IC41 pin 5	CMOS buffer
		IC12 pin 6	Lamp test
10 kHz	IC3 pin 12	IC41 pin 7	CMOS buffer
1 kHz	IC5 pin 7	IC1 pin 39	Scan input for multiplexed display
		IC41 pin 9	CMOS buffer
100 Hz	IC6 pin 7	IC16 pin 12	Gate time .01 sec
		IC41 pin 11	CMOS buffer
20 Hz	IC10 pin 11	IC1 pin 38	Scan reset Resets display
10 Hz	IC10 pin 12	IC16 pin 13	Gate time 0.1 sec
		IC41 pin 14	CMOS buffer
1 Hz	IC9 pin 12	IC16 pin 5	Gate time 1 sec
0.1 Hz	IC8 pin 12	IC16 pin 2	Gate time 10 sec

Table 1.

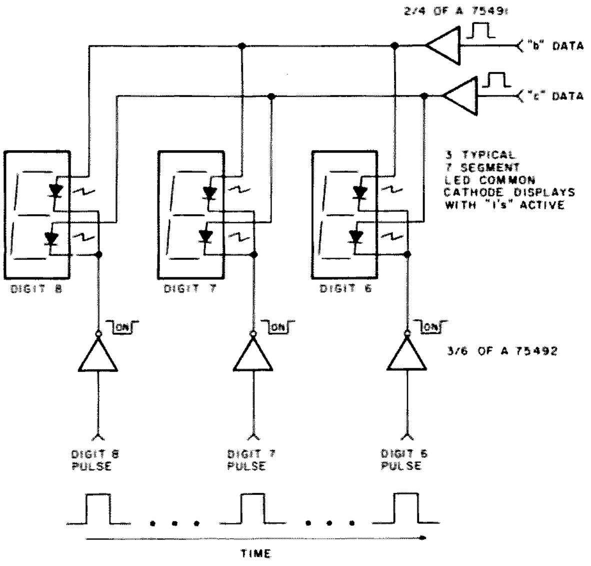

Fig. 8. Simplified multiplexed display example.

incoming pulses both starting and stopping the actual timebase at IC13 pin 2, which is shifted by the interval between event pulses. As long as this period of time between arriving pulses is longer than the difference between the propagation delay of the 74C74, the circuit will synchronize beautifully, allowing only whole numbers of pulses to be counted. This limitation is never realized because of the 5-MHz maximum count frequency into the 7030.

Page 208 in Don Lancaster's *TTL Cookbook* sparked my imagination and curiosity about eliminating the usual last-digit jitter found in most digital counting instruments. This ± 1 digit ambiguity is an error source that is inversely proportional to the measurement frequency. To keep the following example simple, let's assume a 1-second timebase. For a 10-Hz frequency, the ± 1 count results in a $\pm 10\%$ error per sample. At 100 kHz, the error decreases to $\pm .01\%$. If anyone wants an easily-forgotten formula, try this: % error = $\pm$ 100/(H $\times$ g), where H = frequency in Hz and "g" is the gate time in seconds. Notice that this particular source of measurement imprecision is in addition to timebase instability, noise, jitter in triggering, and all the other digital counter gremlins.

Now you can appreciate the slight cost of the couple of extra ICs to eliminate this error, especially for lower-frequency measurements. This important feature is overlooked by virtually all manufacturers of digital instrumentation in the hobbyist's realm.

If you are wondering about the other half of IC13, it is used to produce the proper duration of the timebase. Feeding pin 8 back to pin 12 gives a toggle action, dividing the incoming timebase by two. This gives a symmetrical signal high for the originally selected time, and then low for the same time. This "open gate" signal exits from pin 9 and then goes to the pin 2 data input of the previously-explained gate synchronizer.

A green LED on the front panel indicates gate interval. It is taken from IC13 pin 5, enabled by the AND gate in IC18 and driven from IC39, a 75492. A 220-Ohm resistor limits the current. An interesting side benefit is that uneven triggering of the gate synchronizer will show up as irregular flashing of the gate LED. This is a "poor man's" trigger-threshold indicator, since the incoming events must be continually starting the timebase and turning on the gate LED for reliable counting.

Remember the reset and update/load functions needed to make our ultra-simple counter accurate and convenient? Here's how they are generated in this counter.

The timebase representation from Fig. 3(a) will serve as a point of reference. Ideally, the load/update signal for the display should occur immediately after OPEN, at the beginning of

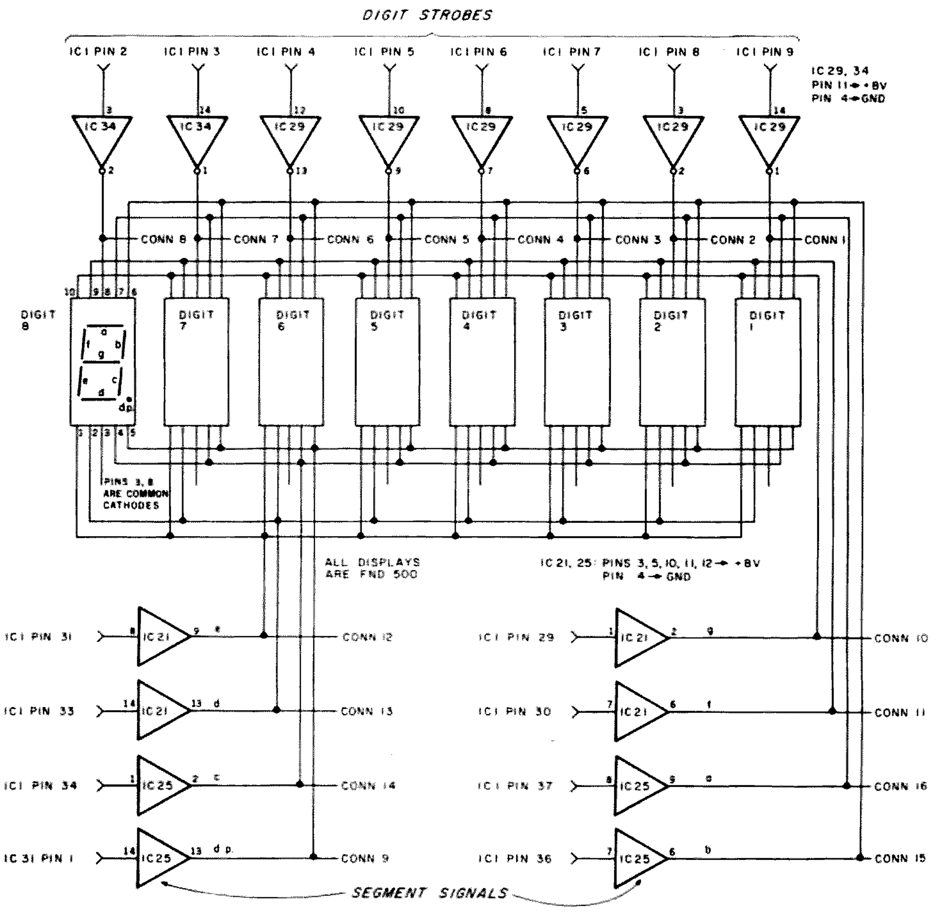

Fig. 9. Eight-digit multiplexed display.

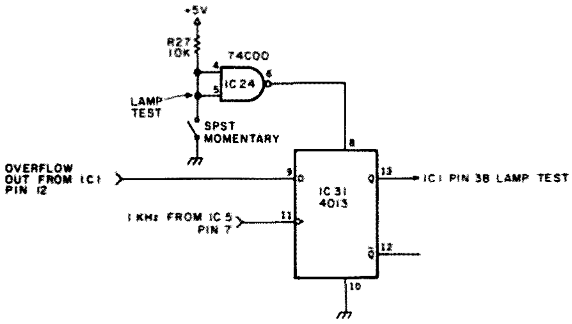

Fig. 10. Overflow lamp-test circuit.

CLOSE. The reset pulse should occur just prior to the start of the OPEN time, at the end of CLOSE time. We have to ensure that the 7030 is undisturbed for the entire prescribed interval, or the display will not be valid.

The load/update pulse is derived economically from the falling edge of the timebase Q_2 output of IC13 at pin 5. This signal is capacitively coupled through the parallel combination of C6 and C7 to the resistor network of R6 and R7. Normally held at +4 volts, the junction of all these components will dip low on the falling edge of the timebase. This "down" time is determined by the RC time constant of $C_6 + C_7$ (capacitive values add in parallel connections) and R_6/R_7. This is close to 15 μs for the values shown. The 7030 needs a load pulse of at least 12 μs to allow for internal settling.

The $\overline{\text{reset}}$ pulse is slightly more trouble. It cannot be taken directly from the rising edge of the count interval because that would result in a reset pulse occurring within the counting interval, destroying any hope of an accurate count. Not wanting to infringe on that accuracy, the $\overline{\text{reset}}$ has to occur *after* the load pulse, or the counter would display only zeros!

After some trial and error (mostly error), I discovered a combination that provides the properly-timed pulse. The successful circuit is shown in Fig. 11(b). Half of IC15 is used. The raw timebase frequency (before division by two) from the clock input (pin 11) of IC13 is enabled for the "no count" time by IC13 pin 6, which, of course, is the out-of-phase (opposite polarity) synchronized timebase. The resulting output at IC15 pin 11 is the inverse of what is needed, so it is inverted by the next NAND at pin 8. Events mode disables the $\overline{\text{reset}}$ by forcing a high output with a low at pin 9. The output at pin 8 is the needed high-to-low transition that occurs only during the no-count interval and not during events mode. From there it goes to the RC network where, similar to the $\overline{\text{load}}$ RC network, a brief negative pulse is generated. In this case it is about 5 μs, the proper duration for the 7030 $\overline{\text{reset}}$ circuitry.

In both these RC networks, the rising edge "glitch" will be ignored because of the bias level produced by the selected resistors and the forgiving characteristics of CMOS.

The mechanism for obtaining the period of the input is basically the same as the one used in the Elementary Counting section above. The timebase and the input signal are swapped with portions of a 74C157 doing the traffic direction. The input signals are first sent through IC7, a 74C90, for division by ten, and then through half of IC13 for an additional division by two. This gives a signal, now divided by twenty, that will become the "timebase" in period measurement. The P (for Period) se-

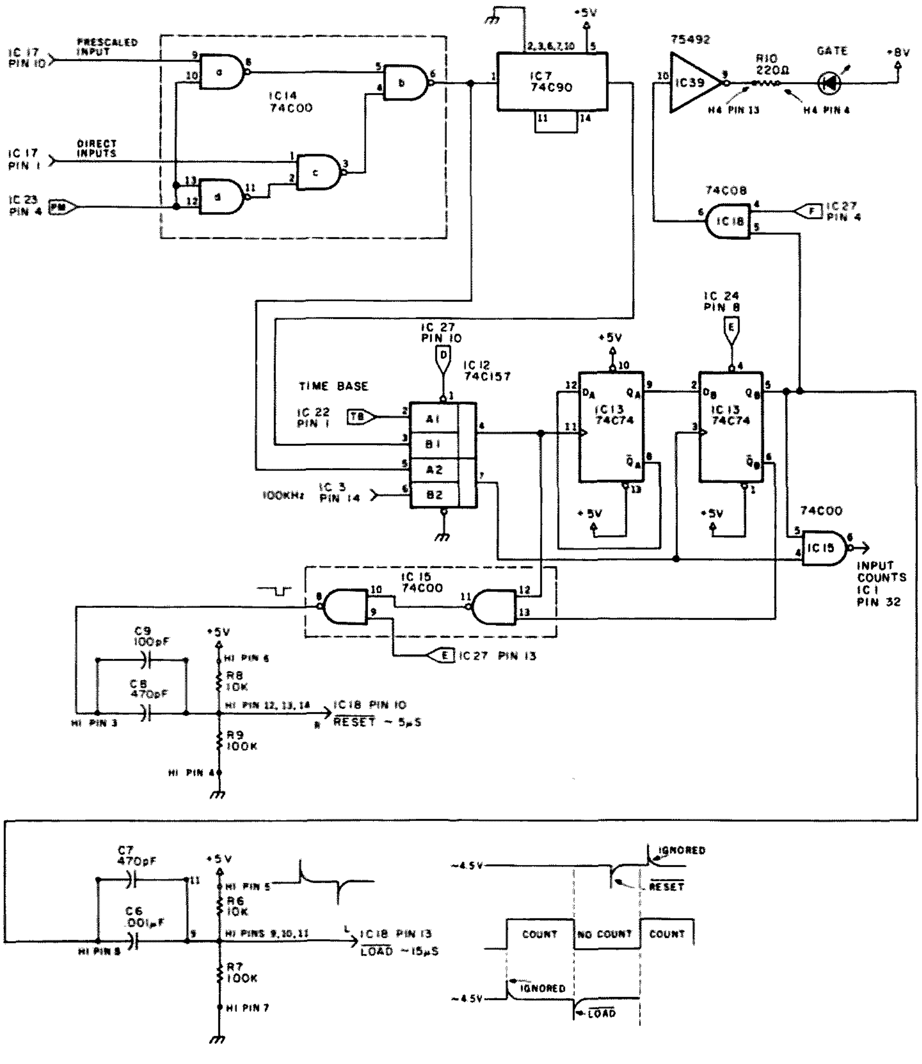

Fig. 11(a). Gate controls.

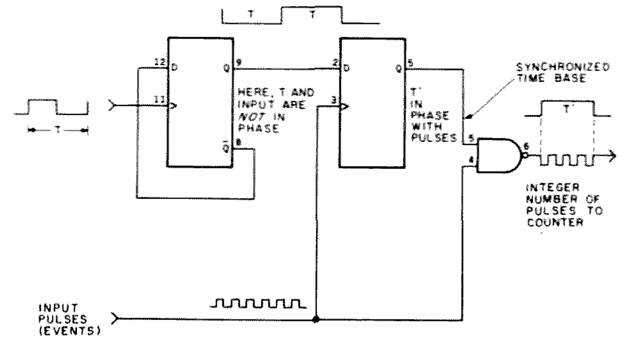

Fig. 11(b). Gate synchronizer.

lect line properly routes the B inputs of IC12 to accomplish this. When P is low, however, the A signals are digitally massaged to provide the normal frequency display.

Now that our period function has a timebase, the counter needs a source of pulses to count. A 50-kHz signal is picked off the TBOD chain. This frequency, when gated by a signal divided by twenty, gives a readout in microseconds. The $\overline{\text{load}}$ and $\overline{\text{resets}}$ remain the same as before.

The reason for prescaling the "unknown" low frequency is to reduce effects of noise on the input signal. Because low-frequency signals for which the period mode is used often are slow-rising leisurely functions of time, noise on the signal can cause false, premature, or late triggering of the counter. The random nature of noise can be put to use in the prescaling, or averaging, of the input signal. The uncertainty in triggering is reduced by the corresponding scale factor. This counter uses a factor of 20 for period averaging as a reasonable compromise between extreme precision and convenient utility.

The price to be paid for the averaging improvement is a correspondingly longer interval before the calculated period display is updated. For instance, if the period of a 20-Hz signal was directly measured, the updates would arrive every .05 seconds. Prescaling by 20 would divide the noise error by 20, but the display would be updated only every second (20 times .05 = 1 second). If your requirements dictate greater period averaging factors, more 74C90 dividers could readily be inserted into the period-measurement circuitry, with another pulse source chosen to give a display of the resulting period in μsec.

The events-mode operation of the counter only requires the withholding of the timebase and the subsequent resets of the counter. By having manual as well as automatic controls over resets and display updates in the counter, elapsed time/event functions are defined.

You're still here? Great! Next month I will cover the rest of the Universal Counter. We'll look at the front-panel design which features push-buttons rather than rotary-style switches. The counter's front end, decimal point, and power supply circuitry are waiting, too. Rounding out the story will be a discussion of construction techniques. Just why did I wire-wrap my counter? Read next month's article and find out. ■

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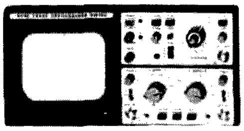
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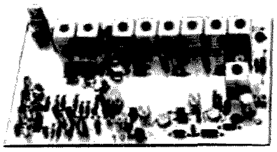
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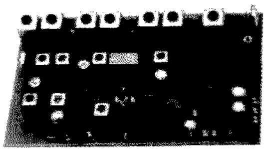
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HAM RADIO'S GOLDEN YEARS

When were ham radio's golden years? It probably all depends on when you first entered the hobby. My golden years were the 1960s: Benton Harbor lunch boxes, Allied catalogues, New York's radio row and the introduction of transistors. For others, the 60s may have meant incentive licensing, a declining ham population, and the first CBers hitting our bands. For me, however, those years will always be the sweetest.

This month's column is all about ham radio's golden years. I hope you'll find a question or two about your era.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) Old top ticket
7) Iran prefix
9) A traditional ham
12) A Zepp, for instance
14) Big time for traffic
16) Not ac (abbr.)
17) First tube
21) VHF rice container
23) Slang for 17 across
26) Iceland prefix
27) Amateur practice

Down

1) Commission before the FCC (2 words)
2) Plate current (abbr.)
3) No danger
4) Morse greeting (abbr.)
5) A satellite signal path
6) Bug maker
8) Old modulation (abbr.)
10) Signal way
11) Operates
13) Spark discharge
15) Ireland prefix
16) Morse slash
18) Contest double-copy
19) Finland prefix
20) Japan prefix
22) New electronics type (abbr.)
24) Transceiver
25) Morse double dash

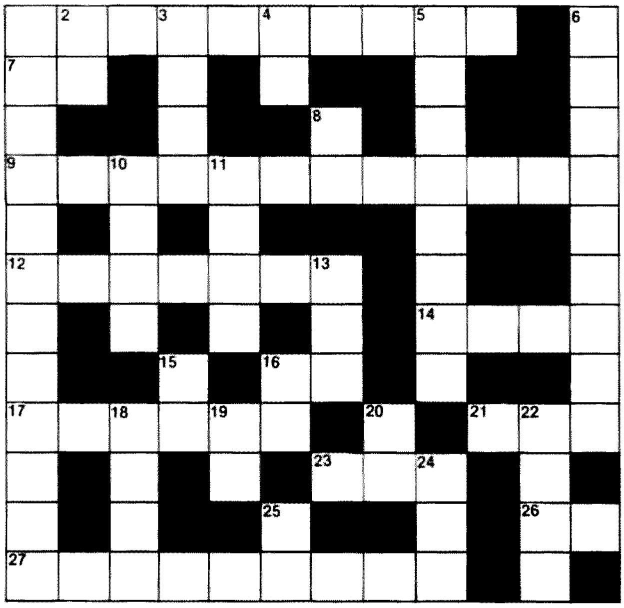


Illustration 1.

ELEMENT 2—MULTIPLE CHOICE

1) In 1958, Lee De Forest was asked by a reporter what would have been his reaction if transistors had suddenly been developed during the early years of the century. What did De Forest reply?
   1. "I would have fainted."
   2. "I would have invented the printed circuit board."
   3. "I might never have invented the audion."
   4. "Weren't they?"

2) What news did thousands of amateurs hear over their wireless sets on the night of November 8, 1916?
   1. News of the formation of the ARRL
   2. The first election night broadcast
   3. News of the sinking of the *Titanic*
   4. Word of the first transatlantic QSO

3) Remember those Fort Orange Radio ads that appeared in *QST* in the 1950s? In the ad, what was flying out the end of Uncle Dave's cigar?
   1. Lightning bolts
   2. Smoke
   3. Radios
   4. Money

4) Which year saw the introduction of the Hallicrafters SX-71?
   1. 1920
   2. 1934
   3. 1950
   4. 1958

5) In the introduction, I mentioned New York's "radio row." What stands on this site today?
   1. The new Madison Square Garden
   2. The Metropolitan Opera House
   3. Shea Stadium
   4. The World Trade Center

ELEMENT 3—TRUE-FALSE

	True	False
1) Howard Hughes was a ham.	______	______
2) The man who played Andy, on radio's "Amos 'n' Andy," was a ham.	______	______
3) The Conditional class license was phased out beginning in 1976.	______	______
4) In 1951, the US government forbade the ARRL to send its publications to the Soviet Union.	______	______
5) In its advertisements for the KWS-1, Collins claimed that SSB signals were "distortion free."	______	______
6) The 1947 WARC was held in New Jersey.	______	______
7) Novices have never had phone privileges.	______	______
8) The Heath Company got its start with "build-them-yourself" airplane kits.	______	______
9) NBVM was a popular operating mode in the 1930s.	______	______
10) A "Model 15" was a type of SSTV gear.	______	______

ELEMENT 4—SCRAMBLED WORDS

Unscramble these names of 1950s ham equipment manufacturers.

SNOHJNO	LINLCOS	IONTANLA	LAMCE
NORAS	SNEOGT	HTAIKHTI	

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1—3 That Lee. What a wit.
2—2 The only problem was, the broadcast proclaimed Charles

Evans Hughes—instead of Woodrow Wilson—as the winner. Oh, well—guess they had to wait for the invention of the computer.
3—1 Forming the phrase "calling CQ." Love them rf cigars.
4—3 A staple for many Novices in the 1960s.
5—4 And I still feel bitter.

Element 3:
1—True. Yes, indeed. His call was 5CY.
2—False. Freeman Gosden, "Amos," was the ham.
3—True. To the dismay of cheats everywhere.
4—True. Wouldn't want the Russkies to get any of the League's precious secrets, would you?
5—True. No consumer advocates back then.
6—True. Atlantic City, to be precise.
7—False. They must have had the privileges back in the 1960s, or a lot of my friends were breaking the law.
8—True. Troubleshooting section: Plane flies backwards. Check motor polarity.
9—False. Baldwin's folly.
10—False. Better check "RTTY Loop."

Element 4:
JOHNSON, SONAR, COLLINS, GONSET, NATIONAL, HEATHKIT, ELMAC.

F	I	R	S	T	G	R	A	D	E	■	V
E	P	■	A	■	A	■	■	O	■	■	I
D	■	■	F	■	■	A	■	W	■	■	B
E	X	P	E	R	I	M	E	N	T	E	R
R	■	A	■	U	■	■	■	L	■	■	O
A	N	T	E	N	N	A	■	I	■	■	P
L	■	H	■	S	■	R	■	N	O	E	L
R	■	■	E	■	D	C	■	K	■	■	E
A	U	D	I	O	N	■	J	■	B	O	X
D	■	U	■	H	■	J	A	R	■	P	■
I	■	P	■	■	B	■	■	I	■	T	F
O	P	E	R	A	T	I	N	G	■	O	■

Illustration 1A.

SCORING

Element 1:
Twenty-five points for the completed puzzle, or one-half point for each question correctly answered.

Element 2:
Five points for each correct answer.

Element 3:
Two and one-half points for each correct answer.

Element 4:
Three and one-half points for each correct answer.

How's your memory?
1-20 points—Erased
21-40 points—Faulty
41-60 points—16K
61-80 points—Sharp
81-100+ points—Golden Oldies!

FUN! MAILBOX

I feel I must point out an error in the True-False section of the May column. The Hazel episode that dealt with TVI showed a pretty good example of misunderstanding and jumping to conclusions. Mr. Baxter thought his TVI was caused by the ham—because his son was visiting the neighbor ham at the same time. Mr. Baxter also injured his back playing golf and was using a heating pad while he was trying to watch TV. At the end of the program an engineer from the electric company tracked down the TVI with an RDF unit. The heating pad had a bad thermostat and this was the cause.

Daniel L. Quigg WD4IRK
Lexington KY

You're absolutely correct. I'd like to say that I slipped in that question just to keep my readers on their toes, but I didn't. I goofed. For penance, I had myself strapped into a chair and forced to watch that episode 50 times on my VCR. As Hazel would say, "What a doozey!"—J. E.

READER'S CORNER

Well, I finally got around to checking the responses to February's Reader's Corner. The Magic Square's solution, not surprisingly, is "73." The following readers correctly guessed the answer: Frank Waldhaus WB1CSE, Dick Milewski N2ABA, Edward Baker N3CLP, Jim Higgens KB3PU, Bernie Lavezza N4FOC, Jim Morris WA6KGB, David Fox KA8CXQ, John Hufschmid KI9J, Dave Karr KA9FUR, Wayne Schuler AI9Q, I. Zender W9IQK, and Jerry Moore W0HMA.

Late arrival: Found one solution to January's DX puzzle—J. Edgar McDermott AH2K.

LETTERS

VIVA "QLF, OM"

I've been receiving *73* for 3 months now. So far, so good. I'm surprised to see someone agrees with my philosophies so extensively. Keep up the good work.

As far as getting more youngsters into ham radio goes, I think the key is reaching out more on their level: demonstrations in science classes and public places; offering classes in ham radio for beginners (WA3WKA and I have had several successful "graduates"); and finally just showing ourselves in a good light all the way around. And, of course, once the spark takes, it must be kindled with good examples from the old-timers. One of the reasons for some of the bad operating practices today is that the old-timers can't or won't put their feet down and correct a beginner's mistakes. (Is letting him develop into a lid doing him a favor? Viva QLF!)

Larry Gotts WA3UKC
Pleasant Mount PA

P.S. I'd sure like to catch you on the air, or for an eyeball sometime, Wayne. We'd have a lot to rag chew about!

Larry, you're right about getting teenagers interested. If they don't see amateur radio working, how can they get interested in it? Look for me around the low end of 20m phone. That's where I hang out when I get on.—Wayne.

RIGHT ON, WAYNE!

I have always wanted to drop you a line; renewal time seems to be a good time to do so. I have been following your articles, magazines, and other achievements since I was first licensed in 1959. You have not always been in the forefront of popularity, but you have usually been "right," and I have enjoyed all of it. I am a member of the ARRL and therefore feel that I am entitled to say whatever I wish. All organizations I have ever been associated with have benefited from criticism, and the ARRL should be no exception. I sometimes tire of those who at-

tack you or *73 Magazine* because you choose to change.

Change is usually for the better. I joined the ranks of amateurs in the middle of the furor over AM vs. SSB, a change for the better. The same happened on 6 and 2 meters, where I worked AM. Now we have a nice proliferation of repeaters. I remember the huge rock-mounted transmitters and now you could hold the modern equivalent in one hand. Drive on, Wayne! There are many loyal supporters in your "silent majority." You do grace the bands with your presence, and it is a pleasure to work you.

Mike Davis K4WYC
Durham NC

By golly, Mike, it has been a long time. Yep, I generated a lot of unfans when I pushed for sideband. More when I pushed for solid state in the 60s. Then a whole new bunch hated me when I pushed for FM and repeaters on VHF. I don't seem to be able to shut up and leave things alone. Oh, i grumble and beef when the FCC does something silly or bad for us... ditto when the ARRL does it... or Bash. But you know, there are a lot of hams... a whole lot... who agree about the FCC, agree about Bash... and then get furious when I mention the ARRL. No, you can't be honest about them or try to put 'em into perspective. It's like religion and politics, a matter of emotion and to hell with facts. Guess I'll never learn to keep my mouth shut or my typewriter turned off. Thanks for sticking with me for so long, Mike.—Wayne.

IDIOTS?

After years of being interested in ham radio from afar, last year I got with it and got my license. I find the technology fascinating, but it wasn't long until I became disenchanted with the content of the QSOs on the air. Banal ramblings which go on and on and on yet say nothing... excruciatingly redundant callsign exchanges with every transmission... and, of course, the very prevalent "CB syndrome," which manifests its presence with seemingly uncontrollable overmodulation and heavy breathing in the mike. Idiots. I thought that there was intelligent life on the ham bands. There are exceptions, of course, but it seems like hardly anyone wants to discuss anything of any consequence. Has it always been like this?

Keith Orosz N6FQE
Seal Beach CA

Intelligent life on the ham bands? Surely you are jesting! No, as a matter of fact, though it is hidden from casual detection, it is there. But I have some bad news for you... it will rarely show its head. The fact is that before you will discover intelligence, you have to exhibit it. I realize that this is a painful fact to face. Keith, I've been hamming for a long time now and I manage to find interesting people to talk with. Often. Oh, I agree that there are some hams who are almost without redeeming qualities. There are some who are so afraid of talking that the best you can get is an antenna discussion, which is not one of my favorite topics. Keith... if you look hard and work out ways of getting through the layer of insulation, you'll find absolutely fascinating people who will enjoy talking with you. There are a thousand things I enjoy talking about. I give hints about some of them in my editorials. I'm alive with information, ideas, interesting experiences... and yet hundreds... perhaps thousands... of hams have contacted me without ever giving either of us a chance to enjoy the contact. Thousands have contacted me and had a contact to remember. It's all in you, Keith, not us.—Wayne.

MORE ABOUT CHARLIE

Upon returning from a meeting of the Montserrat Amateur Radio Society last night, I opened your magazine (which had been given to me that day) and I found your article "Messages from Station Charlie."

During the war, I was a member of the Women's Transport Service, F.A.N.Y., and I was stationed both at the camp shown in the photograph and also at another nearby station. I was a W.T. operator. I was able to recognize the faces in the picture, but unfortunately I was unable to put names to the faces.

It may interest you to know that the Special Forces Association Signals Section is still very much a group, having a newsletter published every four months and meetings twice yearly. Several of the members are still operating.

I will be writing to the Association to tell them all about the article. I thank you for helping me to contact the people mentioned in the article.

Ursula M. Sadler
Montserrat, West Indies

FIRST-CLASS TAPES

I passed my amateur Extra exam last week in Atlanta and would like to extend my thanks for your first-class code practice tapes. My only complaint is that the text proved to be so much easier than the random groups on the tape that I could have gone a couple of weeks earlier! Hi.

Alan P. Biddle WA4SCA
Huntsville AL

Sure, Alan, you could have gone earlier... but I wanted you to be so good at the code that you would not freeze up when faced with the test. By making you able to copy far faster than needed, you probably found yourself feeling confident when the code test started... and able to go right on through it with no problem. Remember that with the old-style code test, you had to copy only one minute solid of that test, but with the new one if you don't get the whole test solid, you can get tripped up by one of the questions. No, you want to have that code sound slow when you sit down to copy it and that's what my tape does for you.—Wayne.

CRANKY CURMUDGEONS?

As a new ham, here are a few observations on this wonderful world of amateur radio. But first: I am retired, having been a professional pilot and a businessman for, well, a long time.

I received my Novice license in November, 1981, my Technician this past February, and plan the General soon. Ham radio was a natural selection since my fascination with electronic things began with watching the old Collins airborne transceivers whir and grind to produce some new frequency that would let you talk to where you were going. That was especially nice if you had been flying over water for about 8 hours. But enough of that or shortly I'll be talking Ford Tri-motors.

So, what is this piercing clarity I propose to offer about amateur radio? First, that I like it very much. The logic of the licensing program (learn and work code as a Novice; upgrade for additional privileges) seems too delicious to have been government-produced. And the things you hear about meeting great people on the air are really true.

But I am dumbfounded at the customer relations to be found in a radio store. Passing the FCC tests is a minor part of becoming a ham. The big thing to learn is how to get along with the omniscient, crotchety people who sell the radios.

Perhaps I can never achieve the stature of these Ancient Icons, but, boy, I really tire of the idiot treatment. And if I am not received as an imbecile, I am labeled an intruder wantonly invading the A.I.'s busy-work-destroying thoughts of dreadful complexity.

I really feel that a person using the simplest sales technique (be cheerful, knowledgeable, helpful) could walk off with the business.

These observations don't emanate from just one store. They include everybody. Wayne, you have sagely said that amateur radio needs new blood. I think the first new blood to hit the sales end of hamming will blow the curmudgeon contingent right out of the water. I would not weep.

But I love the rest of it. I really do. I guess that's really why I wrote this letter.

R. J. Richardson KA6RJJ
Burbank CA

Hey, is R. J. right about this? I have been so well received in the ham stores I've visited that I am not a good judge of what the newcomer faces. How about some letters from readers which might help ham dealers understand what is going on... and how to fix it?—Wayne.

RAG-CHEW AWARDS

After having read and appreciated your editorials for several years, two ideas come to mind for your or anyone's consideration.

First off, why doesn't someone establish an award for DX rag chewing? I can't do it myself. Say the minimum qualifica-

tions to be a half-hour QSO on phone or SSTV or fifteen minutes on CW or RTTY with one ham from each of 100 countries. Additional endorsements could be for conversing with a second ham in each of the same 100 countries or for each of the 100 QSOs to be in the DX ham's native tongue. The certificate awarded should be suitable for the effort involved; 25-50 hours as a minimum amount of time requires brass plaques on walnut or similar cetificates.

Second, I strongly suspect that there is a huge demand for radios with an amateur appearance, especially in the 2-meter FM field. By amateur appearance, I mean big, bulky, ugly boat anchors with a myriad of gauges, knobs, levers, handles, and hasps rather than miraculous, neat little units which could fit in a shirt pocket. I find nothing wrong with the neat units on the market, but somehow I think that non-hams expect us to show up with boat anchors. Recently, at an emergency communications center, after just seeing the neat little boxes, a person in control referred to the hams in attendance as a group of CBers. Major bloodshed was averted only by heroic efforts.

So maybe I'll buy a big, ugly, military surplus chassis and stuff it with a 2-meter rig, power supply, thermos for coffee, and a cooler for the beer. I'll hang some gauges on it and be prepared for the next emergency.

Chris Creasy III WB3AAM
Catawissa PA

Chris, I used to have an award for long-winded folk like me. It was the Real Rag Chewers Club (RRCC) and one had to talk with a station for at least six hours to get the award. Several hundred were awarded.—Wayne.

BANGING CODE

First off—keep gunning! Amateur radio needs awakening if it's to continue as a living, growing service.

i agree with you about the relaxed technical standards needed for a given license. I am not a ham—I have an A.A.S. in electronics and am taking a General class study class that the Kalamazoo amateur club offers. I was totally surprised at how little I had to know about electronics to pass a test! The code should be an added privilege (frequencies w/ license grade)—not a requirement for a license. Most newer hams are more interested in interfacing a computer to their rigs, ATV, microwaves, etc., than banging code. I'm having trouble learning the code and may have to settle for a Technician's license, which would be OK since my main interest is with the possibilities available to me at VHF and above.

Once again, Wayne, keep rattling the cage, and let's both hope the Amateur Radio Service lasts long enough for the old blood to pass on and the newer aspirations of innovation come into control to "pressure" the FCC into awakening.

John E. Allgaier, Jr.
Kalamazoo MI

YES TO CODE

I think you are wrong about a code-free test for a ham ticket.

I am 75 years old and I passed the code test 3 years ago with no problem. The main reason you want to get more hams on the air is to sell more of your magazines and books.

The biggest reason why more people don't go ham, is the cost.

Instead of all the adds for TV satellite material, print more plans for low-cost transmitters and receivers for beginners.

I have had a lot of young people talk to me about ham radio and when you tell them what it costs to start, they lose interest.

I have contacted most of the European countries with only 30 Watts output.

I am sure some of the companies could put out low-priced sets for people who can't afford $700 to $2,000.

Yes, most of the people who take the Bash Test pass. But 2 days after the test, they couldn't answer one simple question on theory.

What we need is a way to get young people interested.

I am willing to give free code lessons and simple theory to anyone in my area.

If other hams would do this, I am sure it would work. Keep the CW.

R. Spencer KA1CEV
Franklin MA

So the whole thing is a con to sell magazines, eh? You sure are a nasty one, Spencer. And with HTs costing a couple hundred dollars, I'm not as convinced as you about money being any serious problem. Indeed, it has been my experience that kids seem to have little trouble getting the money they need for drugs and cars, so perhaps ham gear would not be that difficult if they were interested. My high school informants are adamant when they say that it is the code which is turning the kids off. They want to know why they should learn the code to operate phone, RTTY, slow scan, and so on. I don't have a rational answer for them. And I note that the FCC seems to be going in the same direction, with a dropping of the code requirement for the Tech ticket a good bet. By the way, Spencer, a couple of companies did put out low-cost low-band rigs and no one would buy them.—Wayne.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

NEW JERSEY QSO PARTY
2000 GMT August 14 to 0700 GMT August 15
1300 GMT August 15 to 0200 GMT August 16

The Englewood ARA invites all amateurs worldwide to participate in the 23rd annual NJ QSO Party. Phone and CW are considered the same contest. A station may be contacted once on each band. Phone and CW are considered separate "bands," but CW contacts may not be made in phone band segments. NJ stations may work other NJ stations, and NJ stations are requested to identify themselves as "DE NJ".

EXCHANGE:

QSO number, RS(T), and ARRL section, country, or NJ county.

FREQUENCIES:

1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, and 28610. Suggest phone activity on the even hours; 15 meters on the odd hours (1500 to 2100 GMT); 160 meters at 0500 GMT.

SCORING:

Out-of-state stations multiply

CALENDAR

Aug 7-8	ARRL UHF Contest
Aug 14-15	European DX Contest—CW
Aug 14-18	New Jersey QSO Party
Aug 21-22	SARTG Worldwide RTTY Contest
Aug 21-22	A5 *Magazine* FSTV UHF Contest
Aug 28-29	Occupation Contest
Aug 28-29	Ohio OSO Party
Sep 11-12	ARRL VHF OSO Party
Sep 11-12	European DX Contest—Phone
Sep 11-12	Cray Valley RS SWL Contest
Sep 18-19	New Mexico QSO Party
Sep 18-20	Washington State OSO Party
Oct 2-3	California OSO Party
Oct 16-17	ARCI QRP CW QSO Party
Oct 16-17	Pennsylvania QSO Party
Oct 16-17	BCOA Jamboree-on-the-Air
Nov 6-7	ARRL Sweepstakes—CW
Nov 13-14	European DX Contest—RTTY
Nov 20-21	ARRL Sweepstakes—Phone
Dec 4-5	ARRL 160-Meter Contest
Dec 11-12	ARRL 10-Meter Contest
Dec 19	CARF Canada Contest
Jan 8	*73 Magazine* 40-Meter World SSB Championship
Jan 9	*73 Magazine* 80-Meter World SSB Championship
Jan 15-16	*73 Magazine* 160-Meter World SSB Championship

GEARVAKf
—BULLETIN—

NEWSLETTER CONTEST WINNER

For more than 22 years, the *GEARVAKf Bulletin* has inflicted its own peculiar brand of madness on the world of amateur radio newsletter publishing. It's time the *Bulletin* received recognition for its many journalistic achievements.

Founded sometime in the murky past by the very distinguished Dr. Felix R. Onehundredton, GEARVAKf is more properly known as the Greater Enon AmateuRadioVention And Kite fly (the "f" is silent). Depending solely on reader contributions, this august society produces one and sometimes two issues of its amusing *Bulletin* each year.

The *GEARVAKf Bulletin* strives to cover stories which are overlooked or ignored by traditional amateur journals. Two years ago, for instance, the *Bulletin* broke the exclusive story of the raging fire that nearly destroyed the 20-meter band. A follow-up article detailed FCC plans to install a sprinkler system to guard against future conflagrations.

Strong technical content is a hallmark of the *GEARVAKf Bulletin*. The newsletter has published pioneering articles on such diverse subjects as the Exploding Rat Amplifier and the early closing of the 10- and 15-meter bands due to FCC budget cuts. The exploits of researchers such as Dr. Phugoid G. Dutchroll keep GEARVAKf at the cutting edge of technology.

The *Bulletin* frequently publishes the results of GEARVAKf member polls, which are conducted by the GEARVAKf Public Opinion Subcommittee. Members were asked recently, "How do you feel about current issues?" Fully 84% voted "no," with 11% "yes" and 5% "undecided" about current issues. That says it all.

For wackiness above and beyond the call of duty, editor/ringleader K8DMZ and his cronies deserve heartiest applause. Congratulations to our newsletter of the month, the *GEARVAKf Bulletin*.—WB8BTH.

RESULTS

3RD ANNUAL 160-METER SSB CONTEST*
(Claimed Scores Over 100,000)

SINGLE OPERATORS:

Callsign	QTH	Claimed Score
W9RE	IN	371,580
W8LRL	WV	350,700
WB3GCG	MD	322,660
WB8JBM	OH	315,315
W1CF/1	MA	236,260
WD8CRY	MI	234,240
WBØCMM	CO	230,895
KJ9D	IN	184,670
KC8P	MI	169,800
N5IJ	TX	169,650
N8ATR	OH	164,640
K9QLL	IL	160,950
WØCM	KS	147,600
K9RJ	IL	142,500
KB8HW	MI	138,320
N5CG	OK	135,810
W3BQN	PA	135,730
W9DUB	WI	135,660
KC4OV	TN	130,140
K1MNS	NH	120,725
K1LPS	VT	119,610
W4TMR	NC	117,720
KA7BTQ	ID	111,805
KØSTI	SD	109,080
W4VKK	GA	106,020
W2FJ	NJ	104,430
N7DF	UT	103,880
N4IN	FL	101,100

MULTI-OPERATOR:

Callsign	QTH	Claimed Score
W8NGO	MI	273,900
W4CN	KY	238,950
AK2E	NY	224,750
K9ZUH	IN	213,280
K9YUG	IL	152,400
K9ZX	IL	130,560

Full details and final scores will be featured in a future issue of *73*. Well over 1,000 stations competed—the best year EVER!

sponsored by *73 Magazine

the number of complete contacts with NJ stations by the number of NJ counties worked (21 maximum). NJ stations count 1 point per W/K/VE/VO QSO and 3 points per DX QSO. Multiply total QSO points by the number of ARRL sections (including NNJ and SNJ; maximum: 74). KP4, KH6, KL7, etc., count as 3-point DX contacts and as section multipliers.

AWARDS:

Certificates will be awarded to the first-place station in each NJ county, ARRL section, and country. In addition, a second-place certificate will be awarded when 4 or more logs are received. Novice and Technician certificates will also be awarded.

ENTRIES:

Logs must show date/time in GMT, band, and emission. Logs must be received not later than September 11th. The first contact for each claimed multiplier must be indicated and numbered and a check list of contacts and multipliers should be included. Multi-operator stations should be noted and calls of participating operators listed. Logs and comments should be sent to: Englewood Amateur Radio Assoc., Inc., Post Office Box 528, Englewood NJ 07631-0528.

A #10 size SASE should be included for results. Stations planning active participation in NJ are requested to advise the EARA by August 1st of their intentions so that they can plan for full coverage from all counties. Portable and mobile operation is encouraged.

EUROPEAN DX CONTEST—CW
Starts: 0000 GMT August 14
Ends: 2400 GMT August 15

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operation out of the 48-hour period are permitted for single-operator stations. The 12 hours of non-operation may be taken in not more than three periods at any time during the contest. Operating classes include: single-operator, all-band and multi-operator, single-transmitter. Multi-operator, single-transmitter stations are only allowed to change band one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 through 28 MHz. A contest QSO can only be established between a non-European and a European station. Each station can be worked only once per band.

EXCHANGE:

Exchange the usual six-digit number consisting of RST and progressive QSO number starting with 001.

SCORING:

Each QSO counts 1 point. Each QTC (given or received) counts 1 point. The multiplier for non-European stations is determined by the *number of* European countries worked on each band. Europeans will use the last ARRL countries list. In addition, each call area in the following countries will be considered a multiplier: JA, PY, VE, VO, VK, W/K, ZL, ZS, UA9/UAØ. The multiplier on 3.5 MHz may be multiplied by 4, on 4 MHz by 3, and on 14 through 28 MHz by 2. The final score is the total QSO points plus QTC points multiplied by the sum total multipliers.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and is later sent back to a European station. It can only be sent from a non-European station to a European station. The general idea is that after a number of European stations have been worked, a list of these stations can be reported back during a QSO with another sta-

tion. An additional one-point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported, e.g., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. Only a maximum of 10 QTCs to a station are permitted. You may work the same station several times to complete this quota, but only the original contact has QSO-point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported. Europeans may keep the list of the received QTCs on a separate sheet if they clearly indicate the station that sent the QTCs.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the Contest Committee are final. It is suggested you use the log sheets of the DARC or equivalent. Send a large SASE to get the wanted number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than September 15th to: DARC DX AWARDS, PO Box 1328, D-895 Kaufbeuren, West Germany.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HB0, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1346, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, 9H1.

A5 MAGAZINE FSTV UHF CONTEST

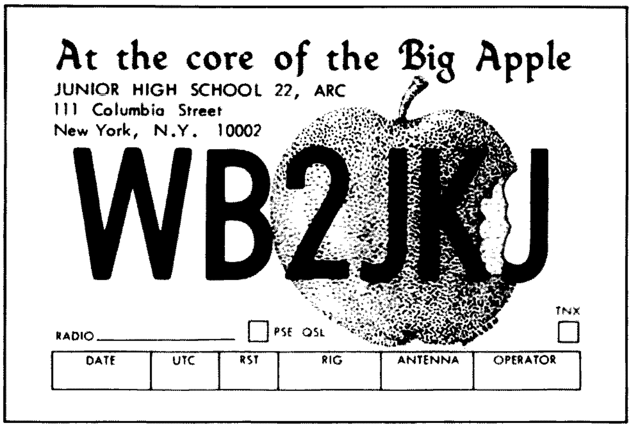
Starts: 1800 EDT August 20
Ends: 1800 EDT August 22

Over $750 worth of prizes will be awarded in the 1982 *A5 Magazine* North American FSTV UHF Contest. This 48-hour ATV contest is designed for the UHF specialized communications operator to work as many FSTV contacts as possible with rewarding bonus multipliers and additions for quality picture transmissions, DX distance accomplishments, and bands utilized. All ATV stations in the United States, Canada, and Mexico are eligible for entry. Even stations without transmit capability can participate utilizing a secondary frequency for voice confirmation of received video. Please note that dates and times are in Eastern Daylight Time (EDT).

Contacts must be made on authorized amateur bands and within power limitations as set forth by the governing agency. Transmission of TV signals in recognized SSB, EME, FM, or satellite portions of the UHF bands will not be recognized and becomes grounds for immediate disqualification of entry. No station may claim another station more than one time per band. Crossband contacts are encouraged and authorized.

Portable, mobile, and airmobile, etc., contacts are allowable as long as verification of location and simplex transmission is used. Contacts via repeaters or any type of relaying device are prohibited. This is not to discourage ATV repeater use, but merely to establish operator and station self-accomplishment. Secondary audio frequencies for signal coordination are recommended, such as 146.43 MHz FM, 7.290 MHz, and 3.990 MHz. Any locally-utilized secondary voice frequency may be used.

For a valid contact to occur, verification must be established by both the receiving and transmitting stations. This can be accomplished by video return, voice communications, hardcopy photography, or lettered QSL. Proof of contact to be included as logbook entry with required information or enclosed photographs to *A5*.



QSL OF THE MONTH: WB2JKJ

Joe Fairclough WB2JKJ had this to say:

I am a Junior High School English teacher and have been since 1968. I have been an amateur operator since 1962.

After several years of using the conventional methods of teaching English and finding they simply do not work on the 7th and 8th graders I'm dealing with, I decided it was time for a change. There had to be a better way. If a child is interested and *wants* to be in school, he will learn.

With the idea of creating interest and excitement, I took the standard English curriculum and revised it all around ham radio. Very basically and briefly, this is what I developed:

1. Teach the children Morse at the beginning of the term and get them to a point at which they can copy their spelling and vocabulary in CW.
2. Use the Novice handbook as the class textbook. Diagram its sentences, examine its parts of speech, etc.
3. Reading assignments from *73*, *QST*, *CQ*, and any other suitable publications.

Our program receives no funds from any government agency or even the school itself. We are totally self-supporting. All our equipment was purchased from the fund-raising efforts of the students and myself. Even down to the postage, it's all done by the kids. It's very difficult to survive this way, but it makes for a great spirit of everyone pulling together, and besides, hams are great people and without them, this wouldn't be possible.

So listen for us on 15. We'll be listening for you.

RESULTS

1982 SSTV CONTEST RESULTS

Activity during this year's SSTV contest was relatively mild, but there were indications of video enthusiasm and acceptance by amateurs on the bands. Slow-scanners were noted on several HF bands, many exchanging reports via color rather than black-and-white SSTV. Quite often, we also noticed contest activity giving way to general-interest SSTV views and idea exchanges. Great! If such interests are sparked and a general attitude of friendship developed, a worthwhile purpose is definitely served. DX signals poured into the US on both 10 and 20 meters during the contest's morning periods, and again during the last hours of each day's operation.

We've received requests for shifting the SSTV contest period from April to January or February (its close proximity to Dayton in April creates a "strain" on contesters). What's your opinion? Another item of interest concerns holding "crossband" SSTV activities between Advanced class and General class SSTVers during the first 15 minutes of each contest hour. Let's hear your opinions either via mail or via the Saturday SSTV net—and soon. Announcement deadlines for the next contest are nigh. Truthfully, we must show more contest participation, gang, or the contest will be doomed to failure. We know many of you operated, but where are those logs?

This year's SSTV contest winner was Mike Di Persio KC2Q, of Bradley Beach NJ. Congratulations, Mike, and enjoy your year's subscription to 73.

Thanks to all for the participation, and we look forward to your support next time. See you on the Saturday SSTV net (1800 UTC, 14,230 kHz).

Dave Ingram K4TWJ
Richard "Brooks" Kendall W1JKF

Video pictures transmitted must contain as a minimum the station callsign and location along with a signal report of the video received. Standard "P" signal reports will be used.

Quality multipliers, DX distance additions, and band usage multipliers will be used as shown later. Standard air or road maps may be used to determine recorded distances. A circle radius should be drawn from the location of the operating station with increments of 25 miles and dots showing locations of stations worked. The map used must be submitted to the *A5 Magazine* contest editor along with all log entry information.

Winners with the highest score in each US call area, Canadian province, or Mexican XE1, XE2, or XE3 areas will receive a free one-year subscription to *A5 Magazine*, a copy of the new ATV book *Everything You Always Wanted To Know About ATV But Were Afraid To Ask*, and a gold Specialized Communications Achievement Award certificate suitable for framing. All entries, regardless of placement, will receive a gold certificate showing participation. The highest-scoring North American winner will also receive a wooden plaque engraving with a large orthodon video tube similar to the *A5 Magazine* Good Image award, along with his photo in *A5 Magazine.*

All entries are encouraged to send photos of station operation and contacts received which will be returned by *A5 Magazine.* Entries must be postmarked no later than September 1st, allowing one week for lettered verifications. All logs will be returned. Please include *A5 ATV Magazine* subscription expiration date information with your entry.

SCORING:

The base points awarded are determined by the type and strength of signal received. Many times on long distance contacts or weak band conditions, only the sync bar level is seen, without a video picture. If indeed verification can be accomplished by both stations on a secondary frequency utilizing the "on-off" method with the receiving station stating the actual "on-off" reception test signals, then low-level points can be achieved. It is to the advantage of both stations to watch the bands or apply more power to obtain a better-quality contact with higher points. Continued quality upgrades, including color reception with sound, enhance higher point totals. In case of better conditions further along in the contest, previous claimed contacts may be erased and upgraded if desired.

FSTV UHF CONTEST SCORING

Base Point Table

Points	Contact Type
1	1-way, verified sync or audio tone bar display
2	2-way, verified sync or audio tone bar display
3	1-way, audio sound detected only (subcarrier or on-carrier)
6	2-way, audio sound detected only (subcarrier or on-carrier)
10	1-way, video picture (b&w) detected
15	1-way, video picture (b&w) detected with sound
20	2-way, video picture (b&w) detected
30	2-way, video picture (b&w) detected with sound
40	1-way, color picture detected
45	1-way, color picture and sound detected
80	2-way, color picture detected
85	2-way, color picture with sound

Picture Quality Multipliers
(Base point times P signal quality level)
Base times 1 = P-0 to P-1 picture
Not usable, lost in noise, limited use
Base times 2 = P-2 picture
Passable picture, high noise level
Base times 3 = P-3 picture
Fair picture, noticeable noise
Base times 4 = P-4 picture
Good picture, slight noise visible
Base times 5 = P-5 picture
Excellent, closed circuit, no noise visible

DX Distance Addition
(Base point times P-signal quality multiplier plus DX points)
Note: Distance figured in miles and rounded to nearest 25-mile marker. Plus 25 points for 25 miles, 50 points for 50 miles, 75 points for 75 miles, etc.

Band Used Multipliers
(Base times P-signal multiplier plus DX times band used)
1200 MHz = times 2
2300 MHz = times 3
Higher frequencies = times 4

OHIO QSO PARTY
Starts: 0000 GMT August 28
Ends: 2400 GMT August 29

Sponsored by the Cuyahoga Falls Amateur Radio Club, the contest is open to all radio amateurs worldwide.

EXCHANGE:

RS(T) and ARRL section, DXCC country, or Ohio county.

SCORING:

Score 2 points for each contact with an Ohio station. Contacts with a Falls member will be worth 10 points and contacts with W8VPV, the club station, will count 25 points. Outside Ohio, multiply your total QSO points by the number of Ohio counties worked on all bands. Ohio stations will score 5 points for out-of-state contacts plus the member and club station bonuses. Multiply your QSO point total by the sum of counties (max.: 88), ARRL sections (max.: 74), and DXCC countries on each band. Phone and CW are considered two bands.

AWARDS:

Plaques to the top station in Ohio and outside Ohio. Certificates to the top station in each ARRL section, Ohio county, and DXCC country. All awards will be made out to the station call on the entry.

ENTRIES:

Each log must show the date/time in GMT, band and mode, and the complete exchange. A copy of the official log sheet and reporting form are available from the club by sending an SASE. Dupe sheets must be completed for any stations with more than 200 contacts. Some form of summary sheet showing the scoring and usual signed declaration are also requested. Send a large SASE for a copy of the results. Deadline for logs is Sept. 29th. All entries and requests for forms/logs should be addressed to: The Cuyahoga Falls ARC, PO Box 6, Cuyahoga Falls OH 44222.

OCCUPATION CONTEST
Starts: 1800 GMT August 28
Ends: 2400 GMT August 29

The Radio Association of Erie PA is sponsoring their second annual contest. The contest is open to all amateur radio operators.

EXCHANGE:

RS(T); occupation; and state, province, or country. Please try to keep occupations in general fields such as engineer, technician, machinist, salesman, etc.

FREQUENCIES:

CW—50 kHz from the bottom of the ham bands. Phone—50 kHz from the top of the ham bands. Repeater contacts are not permitted.

SCORING:

Count 1 point per QSO, with multipliers determined by the number of similar occupations worked. One multiplier point is given for every 3 similar occupations. Final score is the product of the QSO points times the total multiplier.

AWARDS:

A plaque will be given to the top-scoring station. Certificates for the top stations in each state, province, and country.

ENTRIES:

The mailing deadline for logs is Oct. 1st. They are to be sent to: Chris Robson KB3A, 6950 Kreider Rd., Fairview PA 16415.

HAM HELP

I would like to know if the speaker-microphone SMC-24 is available for the Kenwood TR-2400 2-meter HT from a commercial distributor or an individual.

Stephen J. O'Malley N2CLE
35-54 169 Street
Flushing NY 11358

I am looking for any information on the Bendix Aviation Corp. Model 2V13E 450-MHz FM mobile radio—particularly the manual and schematic.

Michael Bilow N1BEE
Forty Plantations
Cranston RI 02920

NEW PRODUCTS

LINEAR AMPLIFIER

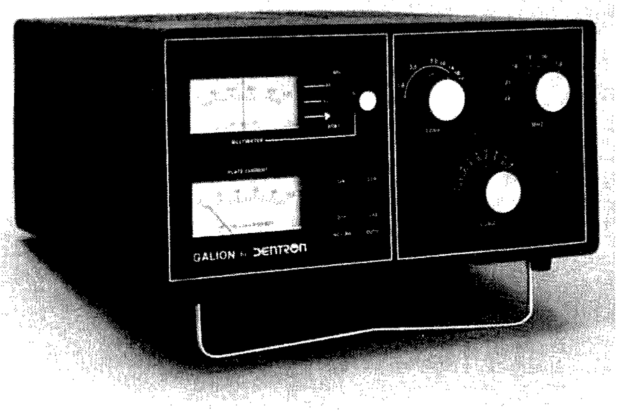
A 1200-Watt SSB, 1000-Watt CW linear amplifier covering 160, 80, 40, 30, 20, 17, and 15 meters is available from DenTron Radio Co.

The "Galion" amplifier features a rugged, reliable 3-500 grounded grid triode, full-function metering, and internal in-out switching. A built-in dual power supply allows it to operate from either 120- or 240-V ac lines while reduced voltage tune ensures peak efficiency regardless of mode. The Galion amplifier includes a tuned input circuit for compatibility with either solid-state or tube-type exciters of any manufacturer.

Improved reliability and performance are provided through an exclusive linearity test circuit, which instantly verifies proper tune-up and operation, and a two-speed blower to provide high volume cooling capacity.

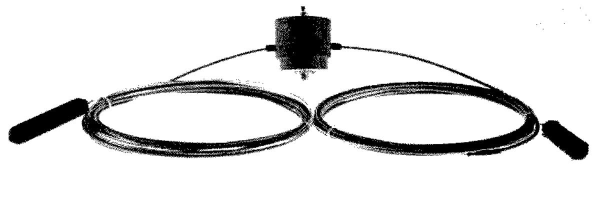
A modification kit available for the Galion amplifier will extend frequency coverage to the 12- and 10-meter amateur bands and associated MARS frequencies. The Galion amplifier is priced at $695.

For more information on the Galion linear amplifier, contact *DenTron Radio Co., Inc., 1605 Commerce Drive, Stow OH 44224; (216)-688-4973.* Reader Service number 482.



The Galion linear amplifier from DenTron.

TERMINALL communications terminal from Macrotronics.



Compensating dipole antenna from Snyder.

COMPENSATING DIPOLE

Snyder Antenna Corporation now offers self-compensating dipoles that offer all the advantages of a conventional dipole plus increased efficiency. These full-band antennas have no resistors or capacitors and can be used with 50- or 70-Ohm feedlines. Available in 40-meter, 75/80-meter, and 160-meter models, prices start at $109.95. For more information, contact *Snyder Antenna Corporation, 250 East 17th St., Costa Mesa CA 92627; (714)-760-8882.* Reader Service number 485.

COMMUNICATIONS TERMINAL

Macrotronics, Inc., has introduced TERMINALL, an integrated hardware and software system which converts the Apple II or Apple II Plus into a state-of-the-art communications terminal.

TERMINALL includes all the necessary computer-interfacing, audio-demodulating, AFSK tone-generating and transmitter-keying hardware integrated in one cabinet. This reduces equipment interconnection to a minimum and allows the operator to be on the air receiving and transmitting Morse or RTTY or ASCII in minutes. Plug it into the receiver headphone jack and copy Morse code, Baudot, or ASCII. Plug it into the CW key jack and send Morse code. Attach a microphone connector and send Baudot or ASCII using audio tones (AFSK).

TERMINALL T2 requires an Apple II or Apple II Plus, 48K RAM, and disk drive. Software provided on disk in DOS 3.2 format (MUFFIN to 3.3). Latched and buffered cable plugs into any card slot (1 through 7).

TERMINALL comes complete with software on disk, assembled and tested hardware, and an extensive instruction manual. List price is $499. For complete information, contact *Macrotronics, Inc., 1125 N. Golden State Blvd., Turlock CA 95380; (209)-667-2888.* Reader Service number 484.

6-METER MULTIMODE

The IC-505 is a fully-synthesized multimode transceiver covering 50 to 54 MHz on FM (option), USB, LSB, and CW. Utilizing an internal battery pack (9 C-size batteries), the IC-505 puts out 3 Watts of rf power when run on its batteries, or 10 Watts when connected to an external 13.6-volt dc source; low power is 0.5 Watts.

IC-505 features include an LCD frequency display for low battery consumption, provision for internal memory backup, dual vfo's, 5 memories plus a call channel, memory scan, program scan, sideband squelch, LCD annunciators for vfo, scan,

IC-505 transceiver from Icom.

memory channel, call and split, and split frequency operation. The transceiver has a list price of $449.

For more information, contact *Icom America, Inc., 2112 116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

SOLAR MODULE

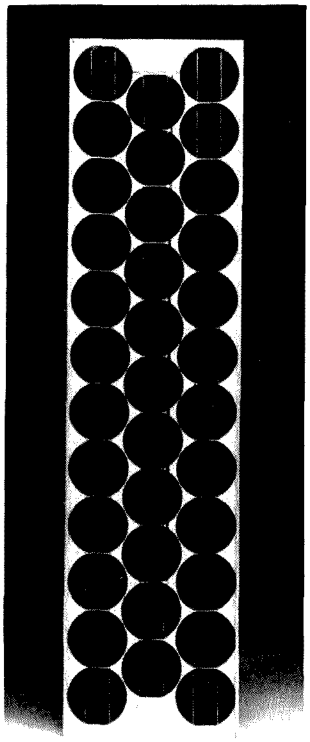
A photovoltaic module that produces 40 Watts of peak power using 35 solar cells is available from ARCO Solar, Inc.

The M51 module is designed for high voltage applications where efficiency and reliability are critical considerations. It maximizes Watt-hours per day while keeping balance of system costs down. It has been successfully tested beyond industry standards.

The new 1'×4' module is 10.75% efficient. Using single crystal silicon cells, it can even charge batteries at five to ten percent of noontime sun. Under such low light level conditions, ARCO Solar analyses show the M51 can deliver up to 25 percent more energy than a typical module of polycrystalline design.

Solar cells in the M51 are 100 percent electrically matched to ensure maximum power output. Each series-connected cell employs 44 contacts for enhanced reliability.

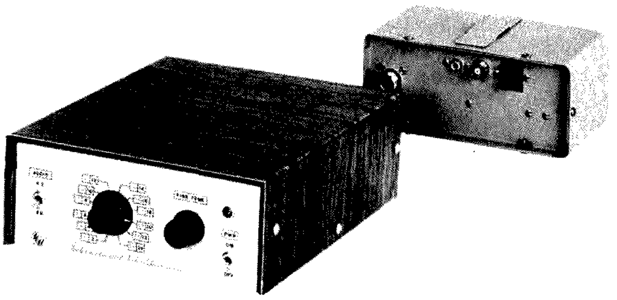
For more information, contact *ARCO Solar, Inc., 20554 Plummer Street, Chatsworth CA 91311; (213)-700-7458.* Reader Service number 481.



ARCO Solar's M51 module.

SATELLITE RECEIVER

The unique two-piece design of the International Crystal ICM TV-4400 satellite receiver permits mounting the downconverter at the LNA. Signal is fed to the baseband unit via RG-59 coax at 70 MHz. The dual-conversion receiver features step-switch tuning with variable fine-tuning control. A subcarrier output may be used with audio accessories. There are two standard audio outputs and a built-in dc block for LNA power. The ICM TV-4400 has a list price of $1295 and is available from *International Crystal Mfg. Co., Inc., 10 North Lee, Oklahoma City OK 73102.* Reader Service number 478.



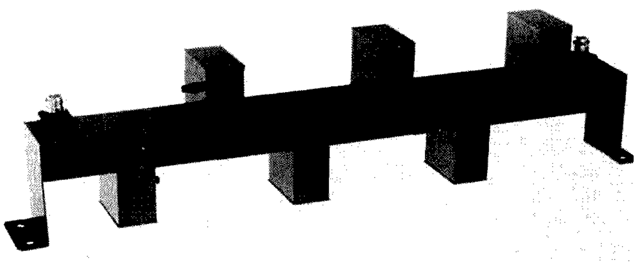
TV-4400 satellite receiver from International Crystal.

INTERFERENCE TRAP

The Model 3966 is a microwave trap for preventing strong microwave carriers from reaching Earth station downconverters.

The trap can block out up to 6 microwave telephone carriers (offset 10 MHz from transponder frequencies). Connectors are type N and the trap passes dc power to the LNA.

The trap is custom-made to customer's specific microwave offenders. Price is $180.00 for a single carrier trap plus $90.00 per additional interfering carrier. Delivery is 10 days. For more information, contact Emily Bostick, *Microwave Filter Co., Inc., 6743 Kinne Street, East Syracuse NY 10357; 1-(800)-448-1666.* Reader Service number 483.



Earth station interference trap from Microwave Filter Co.

1:1 BALUN

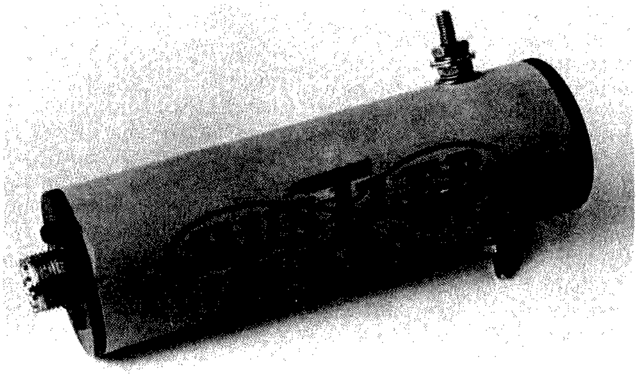
Hustler, Inc., now offers a 1:1 ratio balun to complement their line of HF amateur antennas.

The balun, designated model "BLN," features a low-loss air-core design eliminating saturation at high power levels while maintaining a uniform power balance in the system.

BLN features include a 1-kW input rating and bandwidth of 7 to 35 MHz with under 2:1 vswr.

All stainless-steel hardware and flying leads are supplied for connection to the driven element of beams, quads, or dipoles and coax termination into an SO-239 connector. The BLN is priced at $21.95.

For additional information, contact *Hustler, Inc., Sales Department, 3275 North B Avenue, Kissimmee FL 32741.*



1:1 BLN balun from Hustler.

NOVICE COURSE

A complete Novice course is available from VHF Communications. The course features six hours of theory sent by Morse code. The copy is then given in voice so that the student may check his or her progress. The package includes a copy of the Ameco *Novice Guide*. The introductory price is $21.95. For more information, contact *VHF Communications, 915 North Main St., Jamestown NY 14701.* Reader Service number 479.

APPLE SSTV

The COMMSOFT PhotoCaster™ provides an easy way for hams who own Apple computers to get started on SSTV with a full-featured black-and-white and color system. PhotoCaster includes a circuit board to interface an APPLE to a TV camera and a receiver/trans-

mitter, plus a two-disk software package which incorporates many advanced features.

In addition to transmitting and receiving pictures, PhotoCaster has provisions for adding titles and graphics, creating video special effects, enhancing images, retrieving and storing pictures on disk, printing high-resolution pictures with an MX-80 printer, and much more.

Black-and-white pictures are processed with a resolution of 128 by 128 pixels and 16 levels of gray. Shades of gray are presented on a standard CRT monitor by using dot dithering. In the color mode, 8 colors are available with 16 saturation levels. Color pictures are taken with an unmodified black-and-white TV camera using a three-frame RGB sequence. Standard RGB transmission formats are available in addition to a unique Apple-to-Apple single frame color mode which takes 8 instead of the usual 24 (or more) seconds to transmit a color picture.

PhotoCaster requires an Apple II or Apple II Plus computer with 48K of RAM and one disk drive. The price of PhotoCaster is $499.95 for the basic system which includes an assembled and tested circuit board and software. A complete system consisting of a Panasonic WV1400 camera, board, and software is available for $749.95.

For more information, contact *COMMSOFT, Inc., 665 Maybell Avenue, Palo Alto CA 94306; (415)-493-2184.* Reader Service number 480.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

FCC SAYS MORE 20-METER SSB FREQUENCIES

Expand the 20-meter phone subband? The FCC is considering just this action. Add good sunspots and you have DXer heaven! But what will FCC Docket 82-83 *really* do for DX?

The DXers, nets, and DX presently in the 14200-14250 range immediately will move down to fill the new subband. These operators want to be near the DX portion of the band and will move accordingly. In weeks—if not days—the new frequencies will be every bit as crowded as the bottom end of the 20-meter phone band is today. With any luck, however, the SSTV crowd will stay put on 14230, which will finally get them out of the DX area!

The hams who will benefit the most from the expansion will be the General class amateurs. They stand to gain the greatest percentage increase in frequencies and (depending on the final FCC decision) they might also gain access to that prized bottom 50 kHz! Wouldn't that be a switch! They would go from the status of a poor relation in the 20-meter DX world to head-to-head battles with top DXer W6AM. More likely, the FCC will settle for contiguous subbands and the Generals will gain 14225-75. The 66% increase will propel many a DXer into the ranks of DXCC.

Are there any losers in this proposed expansion? What about the DX hams who use 14150-14200 now? The top half of that range contains many of the DXers, DX nets, and long-haul communications. These hams will share with those stateside or move down, depending on interference to their operation. Below this DX layer lurk the personal, non-DX QSOs: long-standing skeds, families and friends, non-English QSOs. They will be the real losers. The RTTY just below 14100 acts as a floor to phone operators; voice communication below 14100 is almost unknown. Those amateurs who view amateur radio as a communications tool—and not as a pursuit in itself—are the amateurs who will be squeezed from the top as the DXers descend.

Will these hams jump below the RTTY, down to 14050-80? That is the present home of the CW rag-chewer, traffic nets, and domestic communications. You won't find many sharp CW filters here and SSB interference will hurt. Further down, the bottom of the band roars with the CW DX crowd, with kilowatts and filters. They will survive any pressure from above.

So DXers will be the prime beneficiaries of the new frequencies.

What about the other HF bands? In the same docket, the FCC wants amateur opinion on expanding other phone subbands, 80-10 meters. How might these changes affect DX?

Ten meters doesn't need any more phone frequencies; we seldom fill what we have at the peak of the sunspot cycle. Fifteen meters, on the other hand, cries out for phone expansion almost as much as 20. A hundred additional kHz, relocating the Novices to 21050-21150, would attract a lot of the 20-meter operators except at the bottom of the sunspots.

Any 40-meter expansion would force the Novices to move down to 7050-7100, still head-to-head with the VEs, but at least away from the shortwave broadcast stations. This move might be a welcome change! But there is no DX outside the western hemisphere above 7100, so phone expansion would be meaningless to the DXer. Now, if they could only get the foreign broadcast stations to go someplace else (I can think of a certain, overly-warm location), 40 meters could be a great band. But phone expansion? No, thank you.

An additional 25 kHz on 75 meters wouldn't revolutionize DX on the band, but it might go a long way in that direction. 75-meter DX is the exclusive province of the Extra. If other license classes get privileges below 3800, a whole new world of 75-meter DX might open up.

But don't rush onto the proposed 20-meter frequencies just yet. The FCC moves slower than New Hampshire molasses in January, and it will be a while before we can begin moving down. To help our DX totals meanwhile, we might keep an ear out for Erik SM0AGD, from somewhere in the South Pacific.

ERIK SJOLUND SM0AGD: DXPEDITIONER EXTRAORDINAIRE

Erik Sjolund left this spring for an extended DXpedition through the South Pacific, as one of the four-man crew of the 50' yacht *Marathon AQ*. Erik was lured from "retirement" from DXpeditioning by the fact that the skipper of the ship is a descendant of Leif Ericson. The support of the Sundsvall DX group and the Northern California DX Foundation help make the trip possible. The trip's itinerary reads like an atlas of the area (and a ham's dream-come-true): North Cook Islands ZK1, Tokelau ZM7, Central Kiribati T31, American Phoenix KH1, East Kiribati T3, Tuvalu T2, and more. The 1983 itinerary is even more ambitious and includes Spratly 1S! The last group to operate from Spratly had to dodge bullets (more about Spratly in a future column).

What kind of amateur would head off on a scheduled two-year voyage, which includes actively disputed territories, just to hand out radio contacts to the deserving few? Erik Sjolund SM0AGD is a very special amateur and a special person who has operated from more than his share of rare and difficult locations.

Erik began his DXpeditioning career about 11 years ago, when he traveled to Rhodes SV0 for a vacation. Although he had been an active amateur for about 20 years prior, this was the first time Erik operated from outside his native Sweden. The DXpedition bug bit, and bit hard.

Erik traveled extensively through his job with the European Space Agency, and he carried a radio everywhere he went: Easter Island CE0A, the Falklands (or is it the Malvinas?) VP8, and others. Erik then began traveling for the Swedish government to various embassies all over the world.

The well-known neutrality of the Swedish government helped open many doors for Erik. Swedish embassies in such out-of-the-way places as Bangladesh or Botswana were perfect locations for radio operations, and Erik's diplomatic connections paved the way for licensing. Erik also operated from Lesotho 7P8, Guinea-Bissau CR3, Laos XW8, Iraq YI, Turkey TA, and many more. Quite an impressive list! Finally, Erik "retired" and re-

turned to his home and wife, only to head off again this spring.

On his way to the South Pacific, Erik stopped by the International DX Convention in Visalia CA. While there he shared some of his experiences, including his recent trip to J5, Guinea-Bissau, with the hundreds of CA amateurs and guests.

THE SUNDSVALL DXPEDITION TO GUINEA-BISSAU J5AD

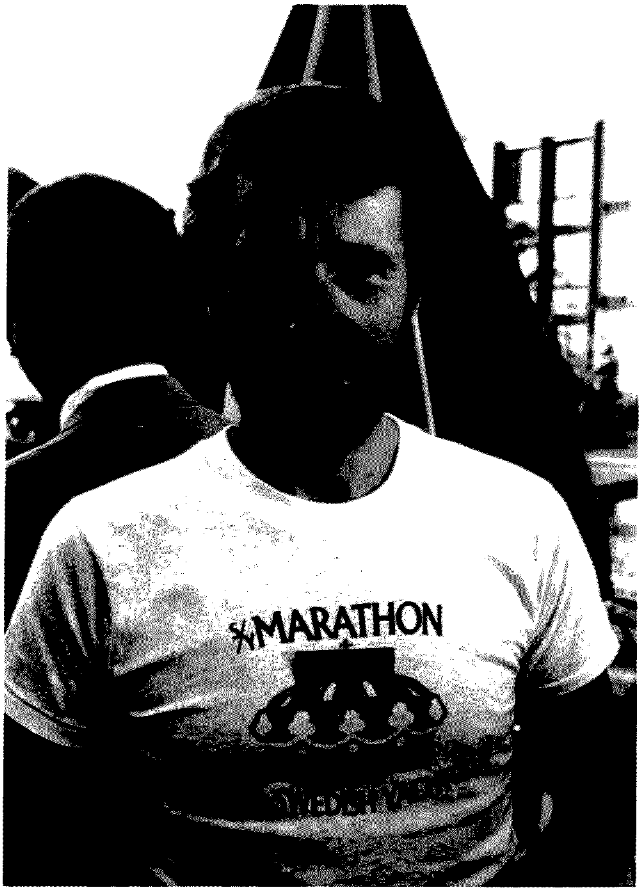
Erik had always wanted to reward his hard-working and dedicated QSL manager, Jorgen Svensson SM3CXS, with a fully-conducted DXpedition. His chance came in 1981, when Erik unexpectedly received permission to operate from Guinea-Bissau J5. Although greatly troubled by a bad knee, Erik immediately begain preparing for the trip: food, hotel, transportation, equipment, customs, antennas. A seasoned DXpeditioner, Erik completely constructed and fully tested each antenna before leaving Sweden.

The travel arrangements centered on Gambia C5, a popular tourist spot for Scandinavians on the west coast of Africa. Erik, Jorgen, and other members of the Sundsvall DX Group arranged to fly a small plane the 300 km from Gambia to the tiny capital of Bissau. To see the countryside, they would chance driving back—a decision which would almost prove their undoing!

Use of the small plane severely restricted the amount of weight the group could carry, and radio gear consumed most of that. Erik had purchased enough food for the entire two-week trip, but there simply was too much weight. So the group sat down to eat the two weeks worth of food before they left two days later!

Erik maneuvered the group's gear, including 2 Icom transceivers, 2 amps, and a couple of vertical antennas, through Gambia customs and rendezvoused with their pilot, C5ADX. A sandstorm in Guinea-Bissau delayed departure for a day, but the group finally arrived and was met by J5HTL, who helped secure licenses and provided other local assistance.

Their troubles were not over, however. Minutes after firing up the radios and getting on the air for the first time, bang! The room went dark. No power. Out-



Erik Sjolund SM0AGD on his way to an extended DXpedition to the South Pacific.

side, the entire town of Bissau was dark. "Maybe we shouldn't have used the amplifier," Erik mumbled, looking out over the dark city of 110,000 people.

The lack of power turned out to be a regular occurrence. Whenever the enormous football (we call it soccer) stadium turned on its lights, the entire city was blacked out. Fortunately (that's experience and foresight), Erik's radios could operate on car batteries, without the amplifiers. A portable generator powered the amplifier when the group was away from the hotel.

Despite the hardships of inconstant power and stomach problems from trying to eat two weeks' worth of food in two days, J5AD managed 20,400 QSOs in 9 days. Contacts were about evenly split between SSB and CW.

Now came the drive back to Gambia, 300 km north. "10 hours," the driver promised. That's about 20 mph on the tortuous dirt roads. The driver appeared with his battered "taxi," but the trunk was completely filled with a barrel of oil. The driver claimed he needed that much oil for the trip, and there wouldn't be any gas stations along the way. More likely, he was afraid someone would steal his precious barrel of oil if he left it behind for a day. He was probably right.

Erik finally convinced the driver to unload the oil and load their gear, and the car began to lurch toward Gambia. But Gambia is a small country completely surrounded by Senegal, and one must pass through Senegal on the way to Gambia. The trouble began at the Senegal border.

Dead tired from the trip and still bothered by his bad knee, Erik refused to pay the implied bribe for passage through Senegal. The border guards retaliated with a three-hour lunch, leaving the Sundsvall DX Group sweltering in the tropical sun. Finally, the two sides reached a compromise and Erik's party headed north. But now the border guard insisted on accompanying the travelers and claimed the front seat. It was a long ride to Banjul, Gambia.

Erik Sjolund and friends survived the trip, however, and pleased thousands of amateurs in the process. And now the modern-day Leif Ericson is off again, this time with transceiver in hand, and SM0AGD portable wherever is on the air again.

QSL Erik's operation via SM3CXS, as usual. Please include a separate envelope for each different callsign, since the cards will be handled in more than one location.

You can recognize Erik by his clean, crisp operating style and his courtesy. Erik also works an even balance between phone and CW. In honor of Erik, and to compensate for the remarks above about the expansion of the phone bands, let's look at a CW topic: zero-beating.

ZERO-BEATING FOR DX FUN AND PROFIT

Zero-beating is the process of aligning the transmitting frequency to that of another station. While important in SSB operation, zero-beating is crucial to successful CW DXing.

The best way to work a DX station in a CW pileup is to transmit on exactly the same frequency as the last successful station. This implies the ability to align the transmitting frequency to that of another station. How do you accomplish this?

The DXer can zero-beat separate receivers and transmitters by means of the spot switch: Tune in the desired frequency on the receiver, press the spot button, and adjust the vfo for an identical note in the receiver. The transmitter is now on the same frequency as the receiver.

But most of us have transceivers without separate external vfo's. No spot switch. Now what?

Again, tune in the desired frequency on the rig. Most transceivers employ an 800-Hz offset for CW. This means that when the dial is aligned on 14030, for example, the CW receiving beat oscillator in the rig (which generates the audible tone in the product detector) oscillates 800 Hz away from the frequency of the transmitting oscillator. If the audible tone is 800 Hz, the transmit and receive frequencies are identical.

But I prefer to copy CW at a lower frequency than 800 Hz. If I adjust my receiver to my preferred note of 650-700 Hz, my transmit frequency will move up 100-150 Hz above that of the other station. That station will shift up in frequency to match my transmitted frequency.

I then shift up still further when the DX station comes back, and we dance up the band. More likely, we will lose contact or never meet in the first place.

We can avoid this problem in either of two ways. First, we can learn to recognize and listen to the 800-Hz note which the rig manufacturers have selected. Or we can adjust the RIT or clarifier to compensate for our personal preferences. I prefer the latter approach.

Tune in a strong, steady carrier, such as WWV. In the CW position, tune across the carrier until the note drops in tone until it disappears. Now move up exactly 800 Hz. Your transmitted frequency should be exactly on the carrier. Adjust your RIT for your preferred note and mark the position of the pointer.

Now, to zero-beat the DX station, tune the rig for your favorite beat note and you will be very close to the correct frequency!

NOTES FROM HERE AND THERE

The French amateur radio society suggests watching for 3A2ARM, the official club station of Monaco, which is often on 14 and 21 MHz Saturdays, 0900-1100Z.

Heard Island plans move ahead, with the support of the Wireless Institute of Australia. An extended stay on Heard is scheduled for early '83.

REVIEW

THE HEIL EQ-200 MICROPHONE EQUALIZER

If you actively seek to improve your transmitter's audio, sooner or later you'll discover the concept of equalization (hereafter referred to as EQ). Simply put, EQ is the boosting or cutting of specific frequencies (or bands of frequencies) within the audio spectrum. In public address systems, EQ is used to flatten out the frequency response of the system, allowing maximum gain at all frequencies before feedback. In the recording studio, engineers apply EQ to sweeten sound and make it more pleasing to the ear.

Obviously, in amateur radio we needn't concern ourselves with either audio feedback or sweetening our sound. So why worry about equalization? Because many years ago researchers discovered that boosting certain bands of frequencies improved intelligibility. A slight boost, say, in the upper-mid-range area, makes our voices easier to understand. Because of this, microphone and transmitter manufacturers have been building such a boost into their equipment for years. More than anything else, this accounts for the subjective differences we detect between the qualities of various microphones and rigs. And it is precisely where we begin to run into some interesting compatibility problems. There is no agreement between manufacturers as to how much boost is necessary or at what frequency it should take place. Worse, some feel that the equalization should be done at the microphone, while others argue that it should be done at the rig. You can imagine the problems this presents! If both the microphone and the rig you buy have substantial boosts at the same frequencies, your audio is likely to sound "honky" and unpleasant. And if a manufacturer designed his rig with the characteristics of a particular microphone in mind, results will be unpredictable with another mike. The combination may lack highs, lows, or anything in between. Or it might have too much of something!

Which brings us to the Heil

EQUALIZING THE MOBILE SIGNAL

When a commercial sound contractor writes the specifications for a sound system to be installed in a large auditorium, he must know the room's resonant frequency. The dominance of this frequency can cause feedback, resulting in a less than optimal gain value for the sound system. By adding an active equalizer that notches out the room's dominant frequency, the likelihood of feedback is reduced, allowing more gain to be used.

The very same sound analysis procedure was applied to the internal cavity of four automobiles. The results were astonishing! From a Honda Civic to a GMC van, they exhibited a large rise in the 400- to 700-Hz range, the exact same place that mobile signals have a large peak in their audio.

If you think about it, you will probably realize that all mobile signals sound alike. It makes no difference what kind of microphone or transmitter is being used. These signals are characterized by low frequency rumble and vey little high-end audio response, and in most cases are very hard to copy when they are immersed in noise.

The fact is that the frequency of the car's internal cavity is reproduced through the mobile microphone and causes all of the signals to include a rumble. The hand-held microphones favored by most mobile operators only make matters worse; they have very little high-end response, with their −3-dB "hinge point" often lying as low as 1800 Hz.

Results from a typical on-the-air mobile setup are shown in Fig. 1. A Kenwood TS-120 transceiver with MC-30S microphone was installed in a GMC van. The signal was received on a Kenwood TS-820S and analyzed with a Heil AA-1 audio analyzer. Before equalization, a pronounced peak was found at 500 Hz, verifying the resonance check. By using a two-band equalizer between the microphone and rig, the resonant frequency of the passenger compartment was notched out, giving the audio a flat response. Next, boost was added to the high end, making up for the deficiency of the microphone. Receiving stations and the audio analyzer back in the lab all reported a 6- to 10-dB difference and there was a marked improvement in the intelligibility of the speech.

We found that articulation is the key factor in understanding a mobile signal. The all-important articulation is lost when the low frequencies predominate. In the worst case, these lows can overdrive the microphone preamplifier, leading to terrible distortion. The application of proper equalization to the audio section of an SSB transmitter will provide this necessary articulation without distortion.

Bob Heil K9EID
Marissa IL

The Heil EQ-200 microphone equalizer. (Photo by KA1LR/4)

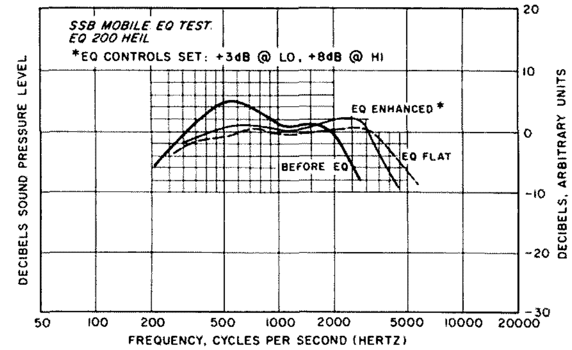


Fig. 1. SSB mobile EQ test results for the Heil EQ-200.

microphone equalizer. The idea is to connect the equalizer between microphone and rig. The LO and HI controls allow you to cut or boost the two bands of frequencies, correcting any deficiencies and hopefully improving intelligibility. A third control permits you to match the output level to what your rig wants to see. Does it work? Well, yes and no. If you just need to perk up your audio a little bit, dialing in a little LO or HI boost can improve things. But it's important to remember that changes you make will only be audible to someone listening to your signal. If you are dumb enough to adjust your rig on the basis of what someone you may or may not know is telling you over the air, you deserve what you get! You really need a means of listening to your own signal while you make adjustments. You're in good shape if you have one of the few transceivers with a monitor circuit. Turn it on, plop on a pair of headphones, and you'll get a pretty good idea of what you sound like to the rest of the world. If you have a second receiver, you are even better off.

One problem we noted in our installation is that the gain control had to be run at a fairly high level. The EQ-200 uses a pair of 741 op amps to do its work, and the noise performance of these devices is less than exciting—i.e., you hear some hiss. While this may or may not be noticeable in other installations, I recommend that Heil use a slightly better op amp in the future. After all, if someone is picky enough to want to EQ their mike line, they aren't going to want to add hiss to their signal!

The second problem I see is the placement of the controls on the front panel. Once you have gone to all the trouble to carefully set them, you don't want anybody messing them up. Internally mounted trimpots with three small access holes for a screwdriver would make the most sense to me.

Conclusions

Used correctly, the Heil EQ-200, which sells for $49.95, can improve the intelligibility of many microphone/transceiver combinations. Used incorrectly, it could make a good signal sound terrible. Please, if you don't have the knowledge or patience to adjust this or any other audio processing device correctly, don't buy it!

For more information, contact *Heil Sound, Marissa IL 62257*. Reader Service number 475.

Paul Grupp KA1LR
Casselberry FL

Editor's note: Heil Sound reports that a design change was made to the final amplifier stage of the EQ-200. By lowering the gain, they achieved a 20-dB reduction of the noise level leaving the unit. This should help in solving the problem, reviewer Grupp reports.

SILICON SYSTEMS DTMF DECODER

Anyone who has tried to tame a dual-tone frequency (DTMF) decoder using the ubiquitous 567 IC has probably thought that touchtone™ control probably isn't worth the hassle. The 567 decoder, although versatile, is far from ideal for decoding DTMF signals that have a variety of levels of distortion and volume. The 567 can give false outputs if input levels aren't carefully controlled, and frequency stability is only as good as the timing network. In short, getting a 567-based decoder working reliably at a remote repeater site is a lot like searching for an honest man—you're always disappointed in the end.

But take heart. Time and technology have passed the 567 by, and thanks to the development of switched-capacitor filters, we now have DTMF decoders in a single package which offer more features and better reliability than a handful of 567s. Silicon Systems, Inc., the people who first made commercial use of switched-capacitor technology, have a chip representative of this new breed in their SSI-201, a 22-pin IC which requires only four external components to operate as a complete DTMF decoder.

The SSI-201 uses 40 poles of switched-capacitor filtering to detect the presence of valid DTMF tones at the input. The filter center frequencies and bandwidths are controlled by a 3.58-MHz crystal (one of the outboard components), so frequency drift and temperature instability are a thing of the past. A valid tone can be detected in as little as 20 milliseconds and the audio input can be anything from 53 mV to 1.3 V. A 60-Hz notch filter on the chip reduces susceptibility to overload from hum.

Implementing the SSI-201 is very easy. Power required is 12 volts at about 30 mA. When valid tones are present at the input, the four output lines present either a hexadecimal (similar to BCD) or binary-coded 2-of-8 output, selectable by tying one pin high or low respectively. The outputs may be configured for either standard CMOS or tristate (high impedance) use. Another control pin allows detection of the full 16-digit set or the more standard 12-digit set. A strobe output is available to ease interface with clocked-logic systems.

A minor flaw with the SSI-201 is that the problem of temperature immunity has not been completely solved. The chip is specified to operate only down to 0° C (32° F), so you'll have to provide some sort of heat at your outdoor repeater site. The answer could be as simple as letting some current flow through a couple of resistors mounted near the chip.

This chip isn't cheap—$60 in single units (if you buy 10 or more, the price drops to $40.64). I buffered all its connections with the real world. I used a 741 op amp as an audio buffer, bypassed the power bus, used a series diode to protect against reverse polarity, and used a 4049 inverter package to buffer the digital outputs. All this may not be necessary, but I feel a lot safer knowing that there's an op amp between the phone line and my expensive chip.

When all things are considered, using a chip like the SSI-201 is well worth the additional cost. Now I *know* that my control system is reliable and that old Ernie with the weird voice won't bring up the autopatch every time he says, "Well, fine business, old man."

For more information, contact *Silicon Systems, Inc., 14351 Myford Road, Tustin CA 92680*. Reader Service number 477.

John Ackermann AG9V
Green Bay WI

ASTRON RS-7A POWER SUPPLY

The RS-7A is one of a series of 13.8-V-dc supplies with ratings ranging from 4 to 35 Amps. The 7A is good for 5 Amps continuous or 7 Amps at 50% duty cycle. I paid $64.95 for mine.

Ripple is spec'd at 5 mV peak-to-peak, full load and minimum line voltage. Load regulation is 50 mV. This is what would be expected from an industrial power supply, but it's much better than many of the supplies built for amateur service. A look at the schematic and the construction explains the performance. The regulator is a 723 IC, a somewhat elderly but altogether respectable chip. Regulator sensing is done at the output terminals, and the sense leads are twisted to minimize magnetic pickup from the transformer. The circuit includes not only foldback current limiting, but a crowbar circuit as well! Thus the unit resists damage very effectively, and if the regulator or the pass transistor should ever malfunction, the crowbar will blow the primary fuse and shut everything down in a millisecond or so. The pass transistor is mounted on a heat sink outside the back of the case, so ventilation is unnecessary. This keeps dirt out of the guts. That, in turn, means that the regulator is unlikely to become humidity-sensitive in its old age.

My unit has a varistor across the transformer primary, although the schematic doesn't show it. Nothing could be more convincing evidence of a thoroughly professional job of power-supply design. If the rig is expected to be available for operation in a disaster, it's extremely important to protect the circuitry against lightning damage. Several pieces of gear in my shack failed during a lightning storm a couple of years ago. After I put varistors across power and telephone line connections, there was no more trouble in subsequent storms. If there are any early-production units out there without varistors (or any other kind of station supply, for that matter), I recommend putting a GE V150LA20B across the primary.

The packaging is what's required, and no more. It's a simple modified steel minibox-style case, with the lid held on with sheet metal screws. Nothing is mounted on the cover; the unit is structurally complete when opened up for service. The line cord is solidly anchored.

The parts are good quality. The main capacitor looks to be either industrial grade or computer grade. I didn't recognize the part number, but it sure isn't any fugitive from a TV set. The

transformer was obviously custom-designed for the job, a requirement when a linear-regulator supply has to operate efficiently over the 105-125-V range.

On-the-air tests... I hooked it up to my UV-3 and dialed up a couple of repeaters I could hit full quieting. The signal reports said there was no audible hum. Key-down operation for 30 seconds caused barely noticeable warming up of the heat sink. Not having access to a power supply test set these days, I didn't carry the testing beyond that. From looking at the size of the heat sink, I'd have some doubts about running at 5 Amps continuously at the maximum rated line voltage, but if that became necessary it would be no trick at all to put on a heat sink about four times as big.

To summarize: Whoever designed this thing has an understanding of what a ham station indoor power supply has to do and knows how to design power supplies. This is probably the most cost-effective supply possible, and it leaves nothing to be desired technically. It's the kind you turn on and just forget about.

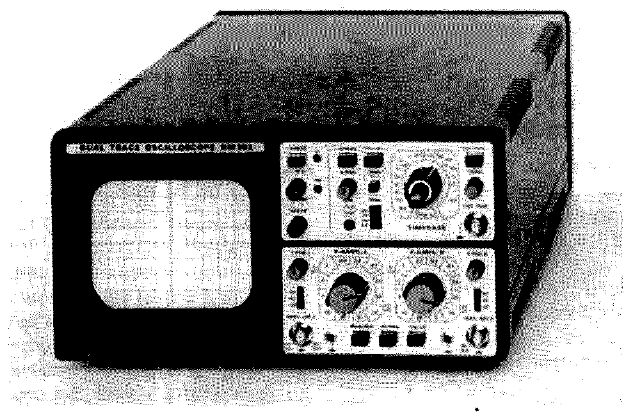
For more information, contact *Astron Corporation, 2852 Walnut—Unit E, Tustin CA 92680*. Reader Service number 476.

John A. Carroll AB1Z
Bedford MA

HAMEG HM203 OSCILLOSCOPE

The Hameg HM203 oscilloscope is much like ham radio: both are international phenomena. The HM203, a newcomer to the US market, features a rugged yet precise feel that one would expect of a piece of gear designed and originally manufactured in West Germany. The outstanding performance/price ratio reminds you of similar gear from the Far East. And not to be neglected is the fact that the HM203 is manufactured and serviced right here in the United States.

Oscilloscopes can be incredibly useful test instruments. Unfortunately, many hams are only familiar with the expensive laboratory-grade units found at work and school or the inexpensive surplus or used models that sell for a song at any swapfest. Hameg has managed to come up with an excellent compromise. Now you can have a dual-trace scope that has a 20-MHz (−3-dB) or 30-MHz (−6-dB) bandwidth, 3% accuracy, and variable triggering for under $600.



Hameg's HM203 dual-trace oscilloscope.

Weighing just over 12 pounds and measuring approximately 6 inches high, 11 inches wide, and 15 inches deep, the HM203 is designed with field-service applications in mind. The unit's compact front panel also lends itself to fitting into a tightly-packed workbench. One half of the unit is devoted to the cathode ray tube, which measures 5 inches diagonally. The usable screen is an adequate 10 cm × 8 cm, and the dark red grid allows you to interpolate measurements to about 0.1 cm.

One feature common to all Hameg oscilloscopes is a subdivided control section. The upper half of the HM203 is devoted to the power switch, intensity, and focus control, plus all of the timebase or horizontal display functions.

The lower half consists of controls for the two Y or vertical channels. The back panel is void except for ac power connection (with removable line cord) and sockets for direct connection to the CRT's vertical and horizontal control plates.

Dual Trace Capability

Two identical vertical channels are available. Each has a 12-step frequency-compensated input attenuator giving scales from 5 mV/cm to 20 V/cm. The attenuator is followed by a diode-protected FET preamplifier that has a 40-MHz bandwidth. Conspicuous by its absence was any kind of continuously-variable vertical sensitivity control. The lack of this kind of control did not prove to be a serious problem, I just made do by adjusting the vertical position potentiometer.

The 1-megohm, 25-picofarad vertical inputs can be switched between ac, dc, and ground. For single-trace or "mono" applications, you can use either channel. For those jobs that require two signals to be displayed, just push in the mono-dual switch and you connect your second signal. Triggering can be done on either channel. (More on triggering later.)

The Alt/Chop switch is an important part of successful dual-trace operations. If the signals have a low frequency (less than 1 kHz), the display will tend to flicker if both traces are displayed Independently. By choosing the Chop mode, the scope switches back and forth between the traces at a 120-kHz rate, displaying both signals on the same sweep and eliminating the flicker.

Timebase

According to Hameg, the HM203 uses a new type of triggering circuit. There is no need for any sort of stability adjustment, since most of the processing is done by a voltage comparator chip whose TTL output drives the sweep generator directly. The result is trouble-free triggering, even with fast-changing, high-frequency, or low-amplitude signals.

The sweep can be triggered by either vertical channel, the line, or an external source. A choice can be made between a positive or negative trigger edge and the trigger level is adjustable. A time axis can be displayed even when no signal is present—just place the 203 in the Auto trigger mode. Service technicians may be interested in the TV trigger mode which operates off the line or frame frequency.

A non-swept or X-Y mode is available by pressing the Hor Ext switch. The X signal is provided via the Y channel I input. The bandwidth of the X amplifier is approximately 2 MHz, with any phase difference between the two axes becoming apparent above 50 MHz.

Looking Inside

In addition to the controls and inputs already mentioned, the HM203 has front-panel access to the TR (trace rotation) control, which allows you to compensate for variations in the earth's magnetic field that cause a misalignment of the trace. The back panel includes access to the power supply fuse and the ability to change between 110-, 125-, 220-, and 240-volt power sources.

Taking the HM203 apart is simple. You just remove two screws and slide the case off the chassis. Once it's apart, you'll discover a straightforward yet impressive layout. The vast majority of the 203's components reside on two circuit boards. This includes most of the controls which are connected to the front panel via mechanical links. With service in mind, Hameg has used sockets for most of the ICs and FETs. The cathode ray tube is surrounded by Mumetal screening, reducing the likelihood of stray magnetic fields causing a problem.

Accessories and Documentation

The HM203 is ready to use the day it arrives. Each one comes with two X1/X10 probes. The Hameg penchant for quality is seen here—the probes include a compensation adjustment and feature interchangeable tips. Although the 203 is good to almost 30 MHz, the probes supplied top out at around 10 MHz. For measurements in the higher range, you can try some of the other Hameg probes. The line of accessories includes test cables, a 50-Ohm terminator, and a simple component testing jig (to be reviewed in a future issue of *73*).

The HM203 manual thor-

oughly documents correction operation of the instrument and even includes a brief discussion of errors that can affect your measurements. Plenty of service information is given, with emphasis on diagnosing and correcting the problem without using expensive test gear. A complete set of schematics is included and they are large enough to be pored over by the armchair circuit-design crowd.

Conclusions

Six weeks of using an HM203 at home and at work have reinforced my first opinions about this scope. It works as billed. The drawbacks such as the absence of a continuously-variable vertical attenuator are offset by extras like a built-in calibration signal. I found that the HM203 fulfilled my needs, which vary from designing simple digital-electronics circuits to troubleshooting a flaky SSB modulator to monitoring the stability of the power in the *73* darkroom. (In the darkroom application, the HM203 was left turned on for almost three days and exhibited no signs of instability or drift!)

I would be the first to admit that the HM203 does not equal the performance you get from many laboratory-grade instruments. But how often do you need 100-MHz bandwidth and features such as trace highlighting? The HM203 is adequate for many service jobs and should fill the needs of almost any hobbyist. With a special amateur price of $529, it beats just about everything, including units that you build from a kit.

The HM203 is available from *Rivendell Associates, RFD 5, Warner Hill, Derry NH 03038.* Reader Service number 487.

Tim Daniel N8RK
***73 Magazine* Staff**

MICRO CONTROL SPECIALTIES' VHF/UHF CONTINUOUS-DUTY POWER AMPLIFIER

Reliability is the name of the game when repeater hardware is concerned. The equipment must be of conservative design unless you enjoy unscheduled trips to the repeater site—trips which always seem to entail a 20-mile drive through the season's worst storm.

The power amplifier is a case in point. You can't simply graft an everyday, mobile-type amplifier onto a repeater system and expect it to provide trouble-free service. Such amplifiers are not designed for the long periods of continuous duty which are faced by most repeaters during some part of each day.

A better choice is an amplifier built from the ground up for repeater operation, such as the PA-75 power amplifier from Micro Control Specialties (MCS). This continuous-duty, 75-Watt amplifier is available in 144-, 220-, and 440-MHz versions. It provides full output with 10-15 Watts of drive. In the interest of reliability, each PA-75 is burned in for four (count 'em, four) days before being shipped.

Most VHF/UHF amplifier circuits are designed to operate from a 12-V dc power source. In contrast, the circuits in the PA-75 use 24 V dc, which is produced by a built-in 105-125-V ac supply. The 24-V design means that the amplifier runs more efficiently, and it allows the power supply to be made physically smaller. The amp *will* operate from an external 12-V dc source and automatically switches from the ac lines to the dc source in the event of an ac power failure. Output power is reduced to 50 Watts when the amp operates on 12 V dc. A pair of 2N5643 final transistors gives the PA-75 its punch. The amp features excellent output filtering, with harmonics suppressed at least 65 dB.

The enclosure of the PA-75 fits standard 19-inch equipment racks. The front panel is kept as simple as possible—just three fuse holders and a dc ammeter for measuring amplifier current. Cooling for the finals is provided by a large heat sink and a high-volume fan. The fan also cools the power supply.

In our 2-meter repeater installation, an amplifier was needed to improve the signal on the far side of a mountain ridge. Since we were already using the MCS Mark 3CR repeater with good success, it seemed only natural to give the matching PA-75 a tryout.

Installation could not have been easier. We simply placed the amp in-line after the exciter output and plugged it in. Voila! Our repeater was transformed from a 15-Watt into a 75-Watt machine.

The amateur net price for the PA-75 is $493 for the 2-meter version, $544 for 220 MHz and $595 for 440 MHz. A $50 discount is available if the amp is purchased at the same time as an MCS repeater.

In five months of operation, our PA-75 has been completely trouble-free. It has performed precisely as advertised and has enabled us to fill some annoying gaps in our coverage. The PA-75 is a rugged, reliable answer to the repeater amplifier question.

For more information, contact *Micro Control Specialties, 23 Elm Park, Groveland MA 01834.* Reader Service number 486.

Jeff DeTray WB8BTH
***73 Magazine* Staff**

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

WORKED TRUMBULL COUNTY AWARDS

The Warren (Ohio) Amateur Association, Inc., announces its Worked Trumbull County (WTC), Worked Trumbull County Mobile (WTC-M), and Worked Trumbull County YL (WTC-YL) awards. These programs are designed to promote increased amateur radio activity among and with Trumbull County Amateur Radio Operators. The awards are also award operating achievements.

Application: Send applications and all correspondence to Don Lovett K8BXT, Awards Chairman, WARA, PO Box 809, Warren OH. One dollar must accompany applications from W, K, and VE amateurs; all others should send three IRCs with application. Only Trumbull County applicants must submit actual QSL cards. All others should have certification letters from two other radio amateurs who signify that they have seen and checked the applicant's QSLs. Each application must also be accompanied by a list of the calls worked, with full log data for each contact.

Requirements:

- WTC—For each certificate or endorsement, Trumbull County applicants must have 20 contacts with other Trumbull County amateurs. Other W, K, and VE stations must contact 10 Trumbull County amateurs, while DX applicants must have five contacts.
- WTC-M—For each certificate or endorsement, Trumbull County applicants must have 20 contacts with other Trumbull County amateurs operating mobile in Trumbull County. Other W, K, and VE stations must contact 10 Trumbull County amateurs operating mobile in Trumbull County, while DX applicants must have five contacts.
- WTC-YL—For each certificate or endorsement, W, K, and VE stations must contact 10 Trumbull County YL or XYL amateurs, while DX applicants must have three contacts.

Award: A certificate will be issued on each approved application but in order to appear on the certificate, special endorsements must be filed with the initial filing, each containing at least 25 percent new contacts. Initial endorsements are free of charge but endorsements made on later dates will take the form of WTC certificates. Applications for these must contain proper filing fees. Endorsements may be "All One Mode," "All One Band," "All Mobile-to-Mobile," or "All Members of the Warren Amateur Radio Association, Inc."

Net contacts, contacts made through repeaters, and contacts made before January 1, 1959, cannot be counted.

WORLDWIDE AWARDS DIRECTORY, VOL. I

If you like to go after awards or win contests, this directory is a must! Volume I lists over 270 awards from all over the world, with names and addresses, costs, and descriptions. $9.95 brings Volume 1 to your doorstep. Volume 2 is in production now and will cost $5.95 for an additional 130 awards. Why not order Volumes 1 and 2 for a combined price of $12.75? The

Worldwide Awards Directory is for the amateur radio operator who is interested in showing his proficiency to others at radio communications throughout the world. You will never know how easy it is unless you know how to go about it. You probably already have enough QSLs in your files for some of the awards. $9.95 includes all postage and handling. COD extra. Quantity discounts available.

Also, if you know of some awards that you would like listed, please let Larry know and they will appear In the next volume. Write to: Larry Kebel KBØZP, 736-39th Street, West Des Moines IA 50265.

HONG KONG AWARDS

HARTS meets every Tuesday at 1700 local, excluding public holidays, at the China Fleet Club, Arsenal Street, Wanchai, Hong Kong Island.

Nine Dragons Award

One contact with a country in each of the following 9 zones: 18, 19, and 24 to 30. Contact for zone 24 must be a VS6. Stations within the 9 zones require 2 contacts in each zone, with 2 VS6 contacts. Contacts after Jan. 1, 1979, only, are valid. Fees are US $3, Aust. $3, £1.50p. postal order, or 24 IRCs.

Firecracker Award

Six contacts with different VS6 stations. Stations in zones 18, 19, and 24 to 28 require 10 contacts with different VS6 stations. Contacts after January 1, 1964, only, are valid. Fees are US $2, Aust. $2, £1 postal order, or 10 IRCs.

Usual Conditions

Certified log extracts only—no QSL cards are required. Payment to be made in cash; no bank drafts. Postal orders to be left blank. Claims to: Awards Manager, HARTS, GPO Box 541, Hong Kong.

HAROAA AWARDS AND CERTIFICATES

These awards are of high quality and will make a very nice addition to any radio room. The awards are available to all licensed amateurs and amateur stations. Please do not send QSL cards. A list showing full details of the contacts (log information) should be certified by one other amateur or radio club officer. Photocopies of your QSL cards or original log will also be permitted. At your request, special endorsements will be added, such as: CW, SSB, all YL, QRP, RTTY, SSTV, one band, etc. If you so desire, you may request separate awards for each special endorsement. Contacts may be made over any period of years. Contacts made through repeaters cannot be used. Satellites permitted. Please pass this award information along to another amateur or post it at your local club. All correspondence or applications should be sent to: **HAROAA, PO Box 341, Hinckley OH 44233, Attn: Awards Manager Gary Zimmerman WB8RTR.**

Application for each award must be accompanied by three US dollars to cover handling and award costs. Payment may be made by cash, personal check, money order, ten IRCs, or first-class-rate US postage stamps. DX applicants may send a money order made out in US funds, ten IRCs, or any of the above.

If at any time your award is lost, misplaced, or damaged in any way, send the date, award number, and pertinent information, and we will replace it free of charge. All awards include the special HAROAA gold seal.

Great Lakes Award

This requires one contact with each state bordering the Great Lakes: New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin and Minnesota.

Super Certificate Hunter Award

This HAROAA award is designed for the serious certificate hunter. To earn this award, you must have a minimum of ten amateur radio operating awards. Simply list the awards that have been issued to you. Special endorsements are 10, 25, 50, 75, 100 plus.

HAROAA DX Award

This is obtained by working DX stations. It is the number of stations worked that is important. Each DX station counts as one, even if several are from the same country or area. Special endorsements for this award are 10, 25, 50, 75, 100, 200 and 500 DX contacts.

HAROAA Insomnia Award

This award is earned by communicating with one other amateur radio station for a minimum of one hour between the hours of 1:00 and 5:00 am. A super conversation piece for your shack.

HAROAA Super Operator Award

This certificate is rendered for those providing a service on behalf of amateur radio, such as weather observation, public service, emergency work, helping a new ham, providing communications for a community function, etc. The requirements are for the applicant to briefly describe the event or service. The officials of HAROAA will determine whether it deserves this special recognition.

HAROAA Official Traffic Handler Award

This award is a self-issued achievement, allowing you to display the fact that you are indeed an official handler of radio traffic.

ISLAND DX AWARD

The IDX Award, sponsored by the Whidbey Island DX Club, is probably one of the most sought after awards in the DX community. This award is available to licensed amateurs and shortwave listeners worldwide.

The IDX Award is issued for

ISLAND DX COUNTRY LISTING

The IDX Awards Program uses DXCC countries which are bona fide "islands" as recognized by the National Geographic Society. The first criterion is that they must have been DXCC countries on or after October 1, 1977, as stated on the DXCC List of the ARRL. Any "qualifying" DXCC country omitted from this list by error or which has been recognized for DXCC after the release of this listing will be added the next time it goes to press. In the meantime, applicants may count these new countries in their tally.

A3	KH1, KB	VP2S
A9X	KH2, KG6	VP2V
BV	KH3, KJ	VP5
C2	KH4, KM	VP8 (Falkland)
C6	KH5, KP6 (King)	VP8, LU (Orkney)
CEØA	KH5, KP6 (Palmyra)	VP8, LU (Sandwich)
CEØX	KH6, AH6, WH6, NH6 (Haw)	VP8, LU (Shetland)
CEØZ	KH6, KH7 (Kure)	VP8, LU (Georgia)
CO, CM, KG4	KH8, KS6	VP9
CT2	KH9, KW	VQ9
CT3	KHØ, KH2, KG6 (Mari)	VR1 (See T3)
D4	KC6 (West)	VR4 (See H4)
D6	KC6 (East)	VR7
DU	KP (Desoth)	VS5, 9M6, 9M8
EA6	KP1, KC4 (Navassa)	VS6
EA8	KP2, KV	VS9 (See 8Q)
EI, GI	KP3, KS4, HKØ (Ran-Ser)	VS9K
FB8W	KP4, NP4 (Puerto Rico)	VU7 (Andaman)
FB8X	KX	VU7 (Lacca)
FB8Z	OHØ	XF4
FC	OJØ	XP (See OX)
FG (Guad)	OX, XP	YB, YC, YD
FG, FS	OY	YJ
FH8	P29	YVØ
FK	PJ (Neth Ant)	ZD7
FM	PJ (St Maarten)	ZD8
FO (Clipperton)	PYØ (Fern)	ZD9
FO (Tahiti)	PYØ (Peter-Paul)	ZF
FP	PYØ (Trini)	ZK1 (North)
FR (Glor.)	S7	ZK1 (South)
FR (Juan)	S9, CR5	ZK2
FR (Reunion)	SV (Crete)	ZL (New Zealand)
FR (Tromlin)	SV (Dodecan)	ZL (Auck-Camp)
FW	T3, VR1 (Central Kiri)	ZL (Chatham)
G, GM, GW (G. Brit)	T3, VR1 (East Kiribat)	ZL (Kerm)
GC, GU (Guern)	T3, VR1 (West Kiribat)	ZM7
GC, GJ (Jersey)	TF	ZS2 (Mari-Pr Ed)
GD	TI9	1S
GI, EI	UA1, UK1 (Franz Jos)	3B6, 3B7
H4, VR4	VE1 (Sable)	3B8
HC8	VE1 (St Paul)	3B9
HH, HI	VK (Lord Howe)	3CØ
HKØ (Bajo)	VK9 (Willis)	3D2
HKØ (Malp)	VK9 (Christmas)	3Y
HKØ (San An)	VK9 (Cocos)	4S
IS	VK9 (Mellish)	5B, ZC
J3, VP2G	VK9 (Norfolk)	5R
J6, VP2L	VKØ (Heard)	5W
J7, VP2D	VKØ (Macquarie)	6Y
JA-JR, KA	VP2A	8Q, VS9
JD, KA1 (Mina)	VP2D (See J7)	8P
JD, KA1 (Ogasa)	VP2E	9H
JD, 7J1 (Okino)	VP2G (See J3)	9M6, 9M8 (See VS5)
JW	VP2K	9V
JX	VP2L (See J6)	9Y
KG4 (See CO, CM)	VP2M	

2 × SSB, 2 × CW, 2 × RTTY, 2 × SSTV, and mixed mode, as well as mixed- and single-band accomplishments. To meet the minimum qualifications, applicants must work fifty (50) IDX islands for the basic award. Endorsements are given in increments of 50 islands, up to and including the maximum number of islands possible.

All DXCC countries which are bonafide "islands" are the only qualifying contacts. A special IDX listing appears within this column. To be valid, all contacts must have been made after October 1, 1977.

To apply, prepare a list of qualifying contacts in prefix order. Please number your contacts 1 through 50, etc. Include the call of the station worked, IDX island name, band, mode, date, and GMT.

Do not send QSL cards! Have your list verified by two amateurs or local radio club officials. Confirmation of each contact must be in the applicant's possession at the time it is being verified.

Send your list of contacts along with $4 in US funds only and a 4- × 9-inch business-size self-addressed stamped envelope to the following address (foreign stations may substitute for the fee by enclosing an SASE and 20 IRCs): Whidbey Island DX Club, Attn: IDX Award, 2665 North Busby Road, Oak Harbor WA 98277.

Rules governing this award program are reviewed annually in the month of September. Please enclose an SASE with any enquiries regarding this award program.

ELMIRA NY

Elmira area amateurs will operate W2ZJ from Chemung County's 1st Annual Good Neighbor Festival 1300Z, July 31 through 2100Z, Aug. 1. Frequencies: 30 kHz up from the lower edge of the General-class phone band on 20, 40, and 80 meters. Special certificate for large SASE to: ARS W2ZJ, General Delivery, Elmira NY 14904.

MT. DAVIS PA

The Somerset County ARC will operate AK3J for the second annual DXpedition from the highest point in Pennsylvania, Mt. Davis, from 1800 UTC August 7th to 1800 UTC August 8th. Frequencies will be the first 25 kHz in the General section for phone and the Novice section for CW. A beautiful certificate will be sent upon receipt of QSL card and $1.00. QSL to Box 468, Somerset PA 15501.

SMYTH COUNTY VA

The amateur radio operators of Smyth County VA, in celebration of the county's sesquicentennial, will be on the air Aug. 21, 1982 from 0000Z until 2100Z. Frequencies will be 15, 40, and 80 meters, up 10 kHz from the bottom of the general phone band and Novice CW band (as activity dictates). The call used will be W4KON. Please QSL with a large SASE for an attractive certificate and booklet about the county to: Ken Sturgill KC4IH, PO Box 526, Marion VA 24354.

SOUTH BASS ISLAND OH

The Huron County Amateur Radio Club will celebrate the 169th anniversary of the Battle of Lake Erie by operating from Perry's Victory and International Peace Memorial on South Bass Island in Lake Erie. The station, WA8HUR, will be on the air beginning at 1000Z August 21, 1982, til 0000Z August 22, 1982. Operating on SSB, the frequencies will be: 3910, 7250, 14280, 21360 and 28550 kHz. The CW station will be found at 40 kHz up from the bottom of each HF band. A Novice station will be found at 3720 kHz and at 7115 kHz. An FM station will be operated on 146.52 MHz. A special QSL card will be issued to all those making contact who send their QSL and an SASE to ARS KF8O.

FLUSH KS

The Kansas State University Amateur Radio CLub, WØQQQ, Manhattan, Kansas, and the Manhattan Area Amateur Radio Society announce the first annual DXpedition to Flush, Kansas, in Pottawatomie County. It will be held on August 29, 1982, for 24 hours of continuous operation beginning at 0000Z.

CW operators can work WØQQQ around 21.112 MHz or 7.112 MHz, and phone operators will find WØQQQ around 14.292 MHz or 3.892 MHz, depending on band conditions.

Successful participants will receive a handsome 8" × 10" certificate by sending an SASE to WØQQQ, Electrical Engineering Dept., Kansas State University, Manhattan KS 66506.

Flush is a quaint metropolis in the beautiful Flint Hills region of Kansas, 12 miles east of Manhattan, home of Kansas State University.

MT. PLEASANT IA

The Mount Pleasant Amateur Radio Club will be operating a station at the Midwest Old Threshers Reunion in Mount Pleasant, Iowa, September 2-6, 1982. Using club call WØMME, they will be operating in the General portion of 80, 40, and 20 meters.

Amateurs from the Mount Pleasant area will also be handling emergency communications on the grounds and will be providing talk-in on 147.99/.39 (WØMME/R) and 146.52 simplex for those attending.

Several hundred amateurs are among the 250,000 people annually that attend this display of memorabilia from America's past. Such things as steam engines, vintage cars, trolley cars, antique radios, and threshing by horse and steam power will be on display.

Hams attending are invited to visit the ham shack and sign the guest book. Admission for the five day event is $4.00. Camping is available on the grounds. For further information, contact Dave Schneider WDØENR, 507 Vine, Mount Pleasant IA 52641.

PIQUA OH

The Piqua Amateur Radio Club (W8SWS/8) of Piqua, Ohio, will operate from the Colonel John Johnston Farmstead, an historical Indian museum, on September 4-6 from 1400 to 0000 UTC.

Colonel Johnston, a federal Indian agent, built his Dutch colonial farmhouse in 1808; it's the only Indian agent house in Ohio. This is Piqua Heritage Festival Days, the first celebration of its kind in the state. Piqua is celebrating its 175th birthday.

A special picture QSL card and 8½" × 11" certificate will be sent to all stations who QSL with a large SASE to Larry Underwood W8UO, 811 N. Sunset Dr., Piqua OH 45356.

Frequencies for W8SWS/8 will be SSB 3.900, 7.250, 14.290, 146.460, and 7.115 (1800-2000 UTC).

PALMYRA

The M.O.T.H.E.R.S. (Marengo Over-The-Hill Electric Radio Society), an informal group of radio amateurs in the north-central Illinois area, have been planning a DXpedition for some time. So far, the destination and duration of the expedition had only been speculation. Last month, however, the destination, Palmyra, was announced. This came after confirmation of a landing permit and operating permission had been received from local authorities. The fact that this Palmyra is located in south-central Wisconsin hasn't dampened the spirits of WB9NKH, K9UA, KF9E, KC9DC, or WA9TAH, the expected operators.

The DXpedition will attempt the landing, initial setup, and possibly some limited operation on September 11, 1982, with a full-blown multi-transmitter operation expected on September 12, 1982, from approximately 0700 to 2100 CDT. The operating frequencies will be up 30 kHz from the bottom of the CW band edges and the General phone band edges.

Since Wisconsin and Illinois have fully reciprocal licensing agreements, the DXpedition will use the call WA9TAH, with QSLs available for an SASE.

CORRECTIONS

The crystal X1 used in the British VHF converter project (April, 1982) is correctly listed as 38.667 MHz in the text and Parts List. The value shown on the schematic is incorrect.

Minor engineering changes made since the design was published include substituting BF274s for the BFW92s used for Q3 and Q4. C6 has been changed from 22 pF to 47 pF.

Tim Daniel N8RK
***73 Magazine* Staff**

SATELLITES

SOVIET SURPRISE!

On May 17, World Telecommunications Day, the Soviet Union placed yet another amateur radio satellite into orbit. However, the unusual manner of its launch and the technical details so far released make it clear that this is no ordinary amateur bird.

The satellite, called ISKRA-2 ("iskra" is Russian for "spark"), was put into orbit by two Soviet cosmonauts who simply pushed the spacecraft out an airlock aboard the Salyut 7 orbiting space station. Several sources, including Radio Budapest, have said that ISKRA-2 carries a 15-to-10-meter communications transponder, which would be the first use of the 21-MHz band for an amateur communications satellite. Telemetry beacons from the new bird have been copied on the high end of 10 meters at 29.576 and 29.875 MHz, using the callsign RK02. At press time, no transponder activity had been heard.

ISKRA-2 is in a rather low orbit, less than 225 miles high. This means that the satellite will have a rather limited lifetime, unless it carries some means by which to raise its orbit.

The launch, which was shown on Soviet television, is apparently only the second of its kind. In 1972, the Apollo 16 astronauts placed a small satellite into orbit around the moon.

PHASE IIIB

It now appears that the long-awaited launch of the Phase IIIB satellite will take place next January and not this summer, as had been hoped. The delay comes as a result of problems with the government and scientific satellites which are the primary payloads for the European Space Agency's Ariane rocket.

Phase IIIB is now scheduled to fly aboard the seventh flight of Ariane, but until the problems with the other satellites are solved, no launches can take place. Meanwhile, the amateur Phase IIIB bird is ready to go.

Thanks to *AMSAT Satellite Report*.

THAT BIG TABLE

Our monthly table of amateur satellite data this month takes on a new form, designed to pack a lot more information into only a little more space. Joining the usual data for OSCAR 8 are reference orbit predictions for four of the Soviet Radio Sputniks, RS-5 through RS-8. Each of these five satellites carries at least one operating communications transponder or robot (automatic QSO device).

This table provides reference orbit data for each day of the month on the cover of this magazine, plus the first half of the following month. For each day during this period, two items of information are given for each of the five satellites. The first number (UTC) is the time (Universal Coordinated Time—same as GMT for most purposes) of the satellite's first northbound equatorial crossing of the day. The second number (EQX) is the longitude (degrees west) at which that crossing occurs. The data in the table is based on the Project OSCAR, Inc., orbital predictions.

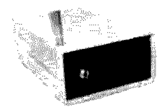
Using these two numbers, there are a variety of ways to determine when any of the satellites will be within range of your location. If you have a microcomputer or programmable calculator at your disposal, you can make use of one of several programs published in *73* and other amateur publications. The new AMSAT Software Exchange has a good selection of satellite tracking programs. The OSCARLOCATER package from the ARRL gets the job done in a simple but effective manner. A completely manual method for making rough estimates of satellite accessibility was presented in the October, 1981, issue of *73*, page 178.

Addresses: AMSAT Software Exchange, Box 338, Ashmore IL 61912. ARRL, 225 Main Street, Newington CT 06111.—Jeff DeTray WB8BTH.

Amateur Satellite Reference Orbits

		OSCAR 8		RS-5		RS-6		RS-7		RS-8		
Date		UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	Date
Aug	1	0022	79	0021	159	0148	183	0153	183	0153	182	1
	2	0026	81	0016	159	0133	180	0144	182	0150	182	2
	3	0031	82	0010	159	0117	178	0134	181	0148	183	3
	4	0035	83	0005	159	0102	176	0124	181	0145	184	4
	5	0039	84	0000	159	0047	174	0115	180	0142	185	5
	6	0044	85	0154	190	0031	171	0105	179	0139	186	6
	7	0048	86	0148	190	0016	169	0056	178	0136	186	7
	8	0053	88	0143	190	0000	167	0046	177	0133	187	8
	9	0057	89	0138	190	0144	194	0036	176	0131	188	9
	10	0101	90	0132	190	0128	192	0027	175	0128	189	10
	11	0106	91	0127	190	0113	189	0017	174	0125	190	11
	12	0110	92	0122	191	0058	187	0007	174	0122	190	12
	13	0115	93	0116	191	0042	185	0157	203	0119	191	13
	14	0119	95	0111	191	0027	182	0147	202	0117	192	14
	15	0123	96	0106	191	0011	180	0138	201	0114	193	15
	16	0128	97	0100	191	0155	208	0128	200	0111	194	16
	17	0132	98	0055	192	0139	205	0118	199	0108	195	17
	18	0137	99	0050	192	0124	203	0109	198	0105	195	18
	19	0141	100	0044	192	0109	201	0059	197	0102	196	19
	20	0002	76	0039	192	0053	198	0049	196	0100	197	20
	21	0007	77	0034	192	0038	196	0040	195	0057	198	21
	22	0011	78	0028	193	0022	194	0030	195	0054	199	22
	23	0015	79	0023	193	0007	191	0021	194	0051	199	23
	24	0020	80	0018	193	0150	219	0011	193	0048	200	24
	25	0024	81	0012	193	0135	216	0001	192	0046	201	25
	26	0029	83	0007	193	0120	214	0151	221	0043	202	26
	27	0033	84	0002	194	0104	212	0141	220	0040	203	27
	28	0037	85	0156	224	0049	209	0132	219	0037	204	28
	29	0042	86	0150	224	0033	207	0122	218	0034	204	29
	30	0046	87	0145	224	0018	205	0112	217	0031	205	30
	31	0050	88	0140	224	0003	202	0103	217	0029	206	31
Sep	1	0055	90	0134	224	0146	230	0053	216	0026	207	1
	2	0059	91	0129	225	0131	228	0043	215	0023	208	2
	3	0104	92	0124	225	0115	225	0034	214	0020	208	3
	4	0108	93	0118	225	0100	223	0024	213	0017	209	4
	5	0112	94	0113	225	0044	221	0014	212	0015	210	5
	6	0117	95	0108	225	0029	218	0005	211	0012	211	6
	7	0121	97	0102	226	0014	216	0154	240	0009	212	7
	8	0126	98	0057	226	0157	243	0145	239	0006	213	8
	9	0130	99	0052	226	0141	241	0135	238	0003	213	9
	10	0134	100	0046	226	0126	239	0125	238	0000	214	10
	11	0139	101	0041	226	0111	236	0116	237	0157	245	11
	12	0000	77	0036	227	0055	234	0106	236	0155	246	12
	13	0004	78	0030	227	0040	232	0057	235	0152	247	13
	14	0009	79	0025	227	0025	229	0047	234	0149	248	14

DON'T TIME OUT. . . . TIME IN



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W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

hibit had a nice restaurant with no wait at all, right in the middle of the lunch hour.

Sherry and I went to the restaurant in the Chinese exhibit for dinner. Tom Salvetti, of Ten-Tec, was with us and we went right in with no wait at all. The food was real Chinese. It was good, but not outstanding. Sherry prefers to use chopsticks when eating Asian food and this was a bit of a problem. The waiter, a Chinese lad from the Knoxville area, explained that they only had three sets of chopsticks for the whole restaurant! He managed to get one of the sets for her, but the rest of us had to eat with forks.

The food prices are a bit above what I'd normally expect, but not astronomical. China seems to be getting all she can out of the fair (they *need* dollars, so that's not a surprise), with their dinners running around $14 per person. That's as bad as a banquet price. Belgian waffles were $2.10 instead of perhaps $1.50...and so on. High, but not prohibitive. They have to get their $110 million back some way, don't they?

In all, I would suggest that if you are going to be anywhere near the Knoxville area, you should allow a couple of days to see the fair. Never mind all the put-downs...it's a good show and the people couldn't be more friendly.

ROCHESTER

The debacle of '81 still hung heavy over the 1982 running of the Rochester Hamfest. It's still a shadow of former years, but perhaps with the relaxation of harassment by the tax people, the exhibitors and then the crowds will be back.

This year there was but *one* major manufacturer exhibiting: Hy-Gain/Telex. A few dealers were there, hoping that the New York tax people would not bring in the police and threaten again to close down the whole show. The dealers seemed to feel that business was okay, considering the economy.

There is a plan to move the banquet to Friday night and keep the show to one day on Saturday. This would allow hams to arrive the night before, attend the banquet, and then spend the day at the show. After a full day of browsing around the flea market, most hams are too tired to wait for the banquet; they just drive home to rest. It may be better to run it Friday night. It's worth a try.

After all of the fuss from *CQ* about attending hamfests, guess who was not there? Heh, heh! But then *Ham Radio* was also conspicuously absent. They seem to have pulled in their horns almost completely and become invisible. *73*'s Jim Gray was there to keep 'em honest...answer questions and fly the flag.

Speaking of the magazines, guess who was at the ARRL booth? There were a lot of rotten remarks about Harry being dead and refusing to lie down. I think that sort of thing is in poor taste. As I've written, I think the least the board could have done for Harry is to make him a president emeritus like they did the previous president. And if they have any real case against him for malfeasance, I think they should bring it out in the open, not just make sly hints about it. Harry should be given the credit he deserves for building up the League, for promoting satellite communications, and for his enthusiasm for packet communications, RTTY, and so on. Let's not have another of those crummy deals like they pulled on Don Miller.

Other than that, Rochester was upbeat this year, looking better. But Harold Smith was almost invisible again this year...where *are* you, Harold? He's the one who almost single-handedly organized and built up the hamfest over the years, turning it from a small independent effort into a genuine ARRL hamfest.

FCC NEWS

The FCC has extended the deadline for filing comments on Docket 82-83 to August 16. Reply comments are due September 16. Docket 82-83 proposes wider phone bands. For more information, see pages 143-145 of the May, 1982, issue of *73*.

The return time limit for Novice exams was extended to 60 days, effective May 6, 1982. This change will be of interest to volunteer examiners who previously had 30 days to return the test papers.

SADDLE STITCHING

In addition to the cover design change, we are also changing to what is called "saddle stitching" of the binding. The idea is to get back to the way we used to be when *73* was running a raft of small construction projects. We want to make the magazine easy to open up while you are working on a project. With the square binding, called "perfect binding," the magazine may look better, but it is a bitch to keep open on the workbench. I really hate it when the magazine flips closed while I'm wiring some chips together.

We're going to be concentrating on publishing as many relatively simple construction projects as we can scare up for you, so get your soldering iron out and start shopping for parts.

A NEW COVER...AGAIN?

Sure, why not? Every few years we get kind of fed up with everything being the same. We look around for ways to make *73* better...or worse, depending on your reactions to change.

The new cover solves some serious problems for us. First, it will stop the continuous flack we've been getting from *73* readers who liked the old contents type of covers. It *is* a lot easier to find things when the table of contents is right there on the cover, no question about that. And since virtually 100% of the *73* readers save their magazines religiously and use them for reference, this is a big plus.

Another problem was our desire to use color pictures brought back from DXpeditions on the cover. If you are not into photography, you may not know that 35mm color pictures can't be enlarged to the full cover size without getting fuzzy. Normally we would want to use a larger film format camera for cover shots...such as a 6 x 6 cm or a 6 x 7 cm such as the Hassleblad or Mamiya RB-67 cameras. These will enlarge and provide sharp cover pictures. Just look at some of the cover pictures on *QST* in recent months and you'll see what I mean...fuzzy.

By running the pictures in a smaller format on the cover, they will be nice and sharp... and look better. Also, we'll be able to run maybe two or three pictures instead of just one.

I realize that you probably are no more a fan of change than I am and will take a few months to get used to the new look. For all my insistence on change being important in amateur radio, I'm as much of a stick in the mud when it comes to change as you probably are. Let's try it and see how it plays.

HAM HELP

I need help on my code speed for the General ticket.

Howard Halperin WB7WDI
4122 West Flower St.
Phoenix AZ 85019

Wanted: Information on the Gonset Model 900A 2-meter Sidewinder. I would like to get in touch with anyone with parts for this unit or who can suggest where these parts can be found.

Peter Mitroff VE3DSW
8 Marsten Dr.
St. Catharines ONT L2N 3C7
Canada

I would like any information on the Globe Electronics HG 303, including manuals and schematics. I will purchase at a reasonable price or will make copies and send an extra set of copies back to you with the original.

Al Wilde W8JZZ
5580 E. Galbraith Rd.
Cincinnati OH 45238

I need a Johnson Viking Model 122 vfo to use with a Johnson Adventurer.

Jack Speer N1BIC
70 Florida Hill Rd.
Ridgefield CT 06877

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7	7	14	21	21A	21A	21A	21A
AUSTRALIA	14	14	14	14B	7B	7B	7B	14B	7B	7B	14A	21
CANAL ZONE	21A	14	14	14	7	7	14	14	21	21	21A	21A
ENGLAND	7A	7	7	7	7	7A	14	14	21	21	21	14
HAWAII	21	14	14	7	7	7	7	14	14	14	14A	21
INDIA	14	14	7B	7B	7B	7B	14	14	14	14	14	14
JAPAN	14	14	7B	7B	7B	7B	7B	14	14	14	14	14
MEXICO	14A	14	14	7	7	7	7A	14	14	14A	21	21
PHILIPPINES	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14	14	7A	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	14	7B	7B	7A	14	14	14A	21	21A	21A	21	14
U. S. S. R.	7	7	7	7	7	7A	14	14	14A	14A	14A	14
WEST COAST	21	14A	14	7A	7	7	7	14	14A	14A	21	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7	7	14	14	21	21A	21A	21A
AUSTRALIA	21	14A	14	14	14B	7B	7B	14B	7B	7B	14A	21
CANAL ZONE	21A	14	14	14	7	7	14	14	21	21	21A	21A
ENGLAND	7A	7	7	7	7	7	7	14	14	14	14	14
HAWAII	21	21	14	7	7	7	7	14	14	14A	21	21
INDIA	14	14	7B	7B	7B	7B	7B	14B	14	14	14	14
JAPAN	14	14	14	7B	7B	7B	7B	14	14	14	14	14
MEXICO	14	14	7	7	7	7	7	7A	14	14	14	14A
PHILIPPINES	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14A	14	14	7A	7	7	14	14	14A	14A	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	14	14	14A	21	14	14
U. S. S. R.	7	7	7	7	7	7	14B	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7	14	14	14
ARGENTINA	21	14A	14	14	14	7	7	14	21	21A	21A	21A
AUSTRALIA	21A	21A	21	14	14	14	14	14B	7B	7B	14A	21
CANAL ZONE	21A	21	14	14	7	7	7	14	21	21	21A	21A
ENGLAND	7A	7B	7	7	7	7	7B	14B	14	14	14	14
HAWAII	21A	21	21	14	14	14	7A	14	14	21	21	21A
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	14A	14A	14	14	14	7	7	14	14	14	14	14A
MEXICO	21	14	14	7	7	7	14	14	14	14	14A	14A
PHILIPPINES	14A	14A	14	14	14B	7	7B	14B	14	14	14	14A
PUERTO RICO	21	14A	14	14	7	7	7A	14	14A	21	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	7B	14	14	14A	14A	14
U. S. S. R.	7B	7B	7	7	7	7B	7B	14B	14	14	14	14
EAST COAST	21	14A	14	7A	7	7	7	14	14A	14A	21	21

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

AUGUST

SUN	MON	TUE	WED	THU	FRI	SAT
1 F/F	2 F/F	3 F/F*	4 P/F*	5 F/F*	6 F/G	7 G/G
8 G/G	9 G/G	10 G/G	11 G/G	12 F/F	13 F/F	14 F/G
15 G/G	16 G/G	17 G/G	18 G/G	19 F/G	20 F/G	21 G/G
22 G/G	23 G/G	24 G/G	25 F/F	26 P/F	27 P/F	28 F/G
29 F/G	30 F/G	31 G/G				

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September 1982 $2.49½
Issue #264

73®

Amateur Radio's Technical Journal

A Wayne Green Publication

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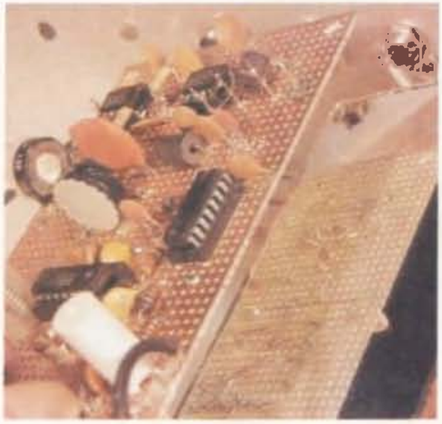
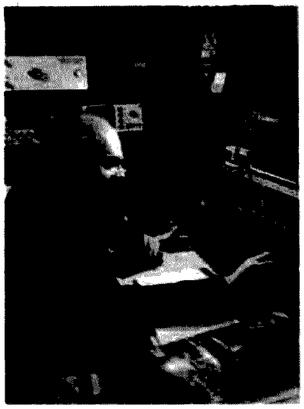


"Cheap Trick" TVRO Receiver—60

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



"Wayne, after having read your editorials for many years I feel I know you personally," said Rudolf Aumann HK1ESU the other day in Cartagena, Colombia. Rudolf, hearing that I was in town for a couple of days, came to my hotel to find me after failing to get through by phone. He found Sherry and me just finishing dinner in the garden of the Cartagena Hilton, where they had served an outdoor barbeque cookout.

I found Rudolf a delightful person with many interests, quite wrapped up in his second hobby of collecting pre-Columbian antiquities. Indeed, he has a collection which rivals those of museums. He found, as have many others, that the real Wayne Green, whoever that is, comes through in my editorials.

The Colombians are most friendly. Sherry and I, taking advantage of the Eastern Air system excursion fare, finished off a hectic business trip with a couple of days of relaxation in Cartagena. This gave us a chance to rest a bit and see a new country. It also added to my count of countries visited.

Of course, getting to Cartagena is an adventure in itself. Having arrived with no warning from either friends who had lived there or from the tourist guidebooks, I found myself knee-deep in the barracudas which inhabit many of the third-world airports. Providence was in my favor in that all of the car rental agencies were closed, it being Sunday afternoon. Sherry had tried to reserve a car for us, but fortunately she wasn't able. I'll explain.

The taxi drivers at airports ...and their pimps...start out asking about two to three times the normal fare. This is complicated by their knowing no English and me knowing little Spanish...or Swahili, or whatever the local language. Eager hands reach for your bags, fully expecting to net at least a buck or two for carrying them even the shortest distance. They assure you that all of the official money changers are closed, but they have a friend who will give you a very good rate...sixty pesos to the dollar.

After bargaining the taxi fare to the bus station down from \$15 to \$10 (\$5 turned out to be more like the going fare), we plopped into a taxi...a 1955 Chevy, I think...and were off to Baranquilla. Unless you've been to a poor country, you have no idea of what poverty can be. We really have nothing approaching it anywhere in the United States. Everything is in disrepair...the streets, the sidewalks (where there are any), the buildings, walls...all broken and falling apart.

Colombian buses are about the only means of transportation, so they are usually packed solid with people. Air conditioning of cars and buses is rare, so the windows (if any) are open. It's hot. Remember that the equator goes through Colombia, so it's hot all year around. There are few private cars in Colombia, so the need for buses is great, with the result that they are everywhere, each fighting to pass the others along the narrow streets. Most of them are gaily painted and decorated, reminding one perhaps of the "art" in the New York subways.

The bus depot turned out to be a street corner more than normally infested with buses. We found the place to buy tickets and splurged a big \$8.00 for two tickets to Cartagena. The bus was scheduled to leave at 2:30 pm, if we wanted a regular bus. If we waited until 6:30 pm we could take an air-conditioned bus! We really didn't want to stand on a street corner in Baranquilla with our hand luggage and two big suitcases for four hours, so we opted for the 2:30 trip. It wasn't bad at all.

Once out of the city, the bus rolled along the narrow road at around 60 mph, passing just about everything in sight. The countryside consisted of sparsely populated rolling hills, with few towns. We did stop occasionally to let the passengers buy food from roadside vendors...freshly cut pineapple slices, pineapple fritters, shashliks on a stick...things like that. At one point, two children got on the bus and went through a ten-minute recitation in exchange for a few coins, getting off at the next stop for a return on the next bus and another recitation.

As the bus threaded its way through the narrow streets of Baranquilla, none with any route markings that I could see, I was most thankful that the car rental agencies had been closed. Imagine trying to find my way through all *that*! Even once out of the country there were few signs at crossroads. Add to all that the seemingly fatalistic driving attitude of the truck and bus drivers and you can see why, even with the heat, I was glad to be making the trip by bus.

The temperature was in the low 90s and not uncomfortable as long as the bus kept moving. The stops immediately started sweat pouring out of every pore. The trip was a bit over two hours to Cartagena, where the bus terminal was even more primitive than the one in Baranquilla. It was not lacking taxi drivers and hordes of baggage carriers, all with dreams of Yankee gold not well concealed. I got the taxi fare down from \$10 to \$2.50 and we were on our way through Cartagena to the Hilton, an air-conditioned luxury respite from the heat and poverty everywhere else.

They even had an ice machine on our floor! We unpacked, relaxed, and had a nice buffet dinner at the hotel. The food was superb. I really needed the rest, not so much from the rigors of the taxi and bus rides, but from the tensions of the previous week.

We'd started out Saturday night with a trip to Chicago. Now one thing you should know about Eastern Airlines is that when you go on a trip just about anywhere on Eastern, you go through Atlanta. Just as Federal, I think it is, ships all packages to Memphis and sorts them, Eastern ships all passengers to Atlanta and sorts them out for their destinations.

Over the next few days we flew Boston-Atlanta-Chicago-Atlanta-Houston-San Antonio-Atlanta-Ft. Lauderdale-Atlanta-Miami-Baranquilla-Miami-Boston. We sure got to know the Eastern Ionosphere lounges at Atlanta.

The first stop was Chicago and the summer Consumer Electronics Show (CES). This was at McCormack Place and was huge. While there was little there in the ham field, the two days I spent there were still well invested. I do have to keep up with home computers, the latest in satellite receiving systems, and discover gadgets such as the new Brother \$200 dot-matrix typewriter with a 16-character

\$\$ HOME-BREW II CONTEST \$\$

It is not too late to submit an entry for *73*'s Home-Brew II Contest. Until October 1, we'll be looking for articles describing the best home-brew projects for under \$50. The winners will share \$500 in cash prizes. For complete details, see page 6 of the June, 1982, issue of *73*.

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LCD readout which permits some rough editing of the material before it is printed. The new Sony pocket TV was interesting, too. And I was pleased to see our book of programs for the Casio 702P on display in the Casio exhibit.

Atari had one hell of a press party to announce their relationship with Spielberg. Fresh oysters, escargots. . . it was a fantastic buffet. The way to my heart is definitely through my taste buds.

For some reason, both the CES and the NCC (National Computer Conference) were running concurrently, so Sherry and I had to see as much of CES as we could in two days and then get aboard Eastern for another trip to Atlanta and then to Houston.

NCC, like CES, was a madhouse. The attendance was probably about the same, somewhere in the 80,000 or so range. Like CES, I could easily have spent the four days of the show seeing it, meeting old friends, and catching up on new products. I did spend a good solid two days looking over perhaps twenty or more new microcomputers, a wide variety of new hard-disk drives, and enough

Continued on page 126

QSL OF THE MONTH: W7VZ

If this innovative eye-grabber makes you thirsty, it's no accident. Send *your* QSL entry, in an envelope, to QSL of the Month Contest, Editorial Offices, *73 Magazine*, Peterborough NH 03458. Be sure to include your choice of book from 73's Radio Bookshop.

Well . . . I Can Dream, Can't I? **by Bandel Linn K4PP**

"I know you need the extra space for ham radio, so my mother is moving out!"

Albert D. Hearn WA4GKQ
98 SW 13th Avenue
Boca Raton FL 33432

Micro Modem

—a RTTY TU designed for computers

This article describes an easy-to-build AFSK (audio frequency shift keyed) modulator and demodulator unit specifically designed for microcomputer RTTY operation. I take the liberty of using the term *modem* here in describing this unit since it is the common computer-related term for devices which perform digital-to-audio signal conversions [mo'dem (mō'dəm) n. an acronym for the term *mo*dulator-*dem*odulator. A device used for communicating digital information over analog transmission systems, such as telephone or radio]. Conventional RTTY terminology defines this as a terminal unit.

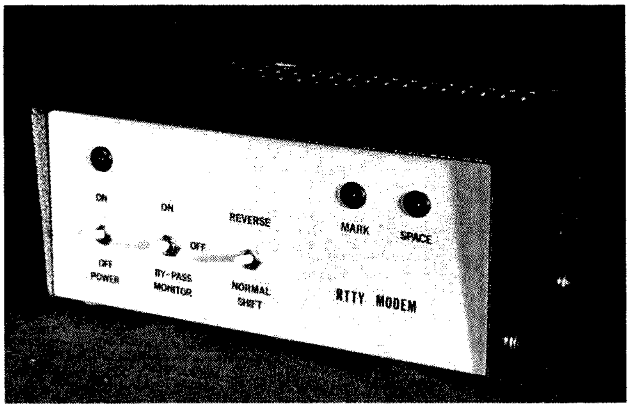
I would like to start by telling you a little about how and why I decided on the particular design I chose. I don't know about you, but I frequently find it frustrating to read a construction article and not have the author tell me how his design is different from other similar designs, in what ways it is better, and what led him to take his approach. I believe you can appreciate the result more when you know the rationale for its being.

I knew very little about RTTY mode when I started. I read back issues of *73*, picked up a copy of the *RTTY Handbook*,[1] and talked to friends. I soon learned the basics and realized that there were only two things preventing me from getting on the air—a program for my microcomputer and a modem to convert RTTY AFSK tones to digital TTL-level signals, and vice versa.

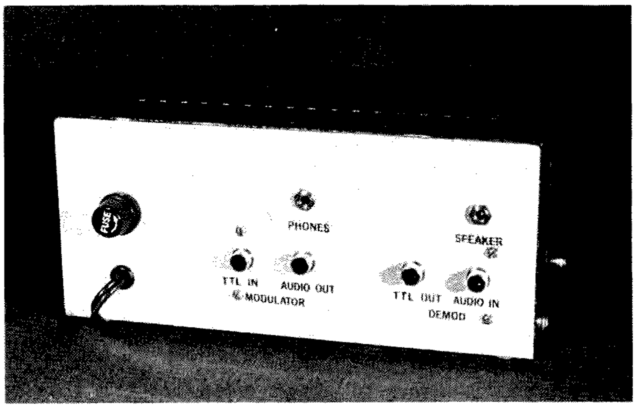
Writing the send-receive computer program to translate serial Baudot data to parallel ASCII (for the video display), translate parallel ASCII (from the keyboard) to serial Baudot, and manage the keyboard and display operation was not as difficult as I had imagined. Again, previous *73* articles and the monthly RTTY Loop column by Marc Leavey WA3AJR were extremely helpful. The June-July issues of 1978 and 1979 contained programming flowcharts and descriptions which are easily adaptable to most any type of computer.

The next step was deciding what to do about a modem, or terminal unit. There seemed to be an abundance of TU gear available from various manufacturers, but there were a couple of problems with nearly everything I saw. First, the prices were out of line with what I was willing to pay. Second, most had features (for example, loop power supplies and autostart) which were for users who were operating conventional electromechanical TTY terminals, not computer terminals. Other features such as wide (850-Hz) shift and CRT tuning indicators were likewise judged as not necessary for my initial system.

The only other avenue open to me was to consider building my own terminal unit. From my research into the various ham magazines, I found numerous TU construction articles. Some described only modulators, others only demodulators, and still others described complete units. I was looking for something that was relatively simple, inexpensive, and yet would give me good operational perfor-



Front view of RTTY modem.



Rear view of RTTY modem.

mance under typical HF RTTY conditions—and would work with my microcomputer.

Selection of an AFSK modulator was settled when I saw the article in *73* entitled "Experimenting with Tones."[2] The Exar XR2206 function generator IC can be easily connected as a very stable two-tone oscillator and can be keyed using a TTL-level input. A breadboard version of a 170-Hz shift generator confirmed my feeling that this was the circuit I was looking for. More on this later.

Selection of a demodulator circuit was a different and more difficult matter. The designs based on phase-locked loops (PLLs) like the 565 and the 567 appealed to me because they are inherently frequency selective, relatively immune to noise, and are specifically intended to perform FSK demodulation. Furthermore, they are simple to work with and are inexpensive.

I first breadboarded a circuit based on the 565. This worked fairly well but seemed much more sensitive to noise and QRM than I was comfortable with. Too, it required a relatively large number of components external to the IC for filtering, signal conditioning, and TTL-level conversion. After a while I realized that the same functions could be accomplished using the more comprehensive capabilities of the 567 tone detector IC and could be done with considerably fewer external components. The 567 also operates on a 5-volt supply which means that no TTL-level conversion is required on its output.

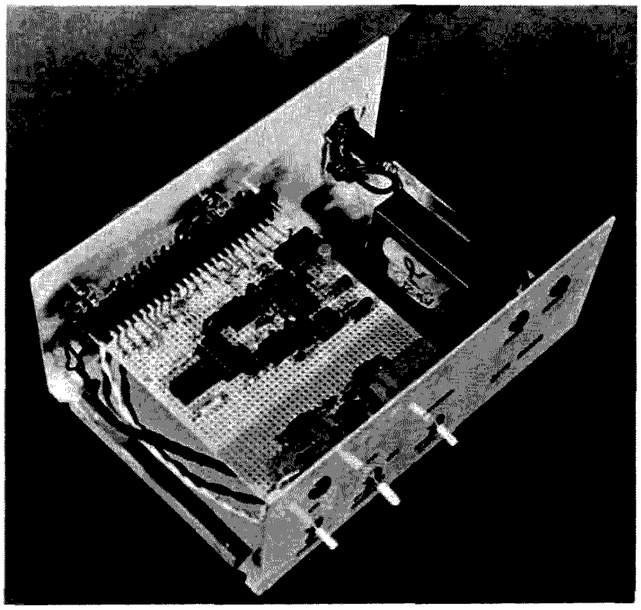
Most published designs of 567-based demodulators use the single tone detect technique in which only one 567 is set up to detect only one half of a RTTY signal—either mark (2125 Hz) or space (2295 Hz). Absence of the desired tone is interpreted to mean presence of the opposite tone. In other words, if the detector is set to look for mark, any time a mark is not being received, it is assumed that a space is being received. Obviously this assumption can be all wrong under conditions where fading and noise are causing signal outages. Also, it makes tuning difficult because CW signals look like RTTY to the detector. You must actually listen to the signal to determine the difference.

Even though I felt that some of the designs I had seen were less than ideal, I also felt that I wanted to use the PLL approach—specifically the 567. Basically, it seemed that a demodulator based on two PLLs, one for mark and another for space, would be the most significant improvement. I would discover later (after having breadboarded a version of this type of circuit) that there were other improvements which could be made.

One of the things I learned about the 567 is that its detection bandwidth is extremely dependent upon the level of its input signal. Most designs I have seen do not attempt to manage the bandwidth, but rather attempt to simply keep input level below the maximum at which the device will still function. Below that maximum, varying input levels cause bandwidth also to vary over a wide range. A consistently small bandwidth would be preferable in order to reduce the effects of QRM. This meant that I would want some type of limiter in my design which would maintain a minimum input to the 567.

Another characteristic of the 567 that caused me concern was the fact that the output will "chatter," or bounce, briefly when turning on. This is somewhat dependent upon certain combinations of input level, component values, and how far off center frequency it is operating. This apparently causes no problems when this type of circuit is used to drive conventional electromechanical TTY gear because of the relatively long response time of its components. It can be a problem, however, when used to drive a computer terminal or other digital logic devices. This problem also would have to be solved in my demodulator design.

Let's take a look now at an overview of the circuit I finally decided upon.



Interior view. 22-pin PC board plugs into socket mounted on rear panel.

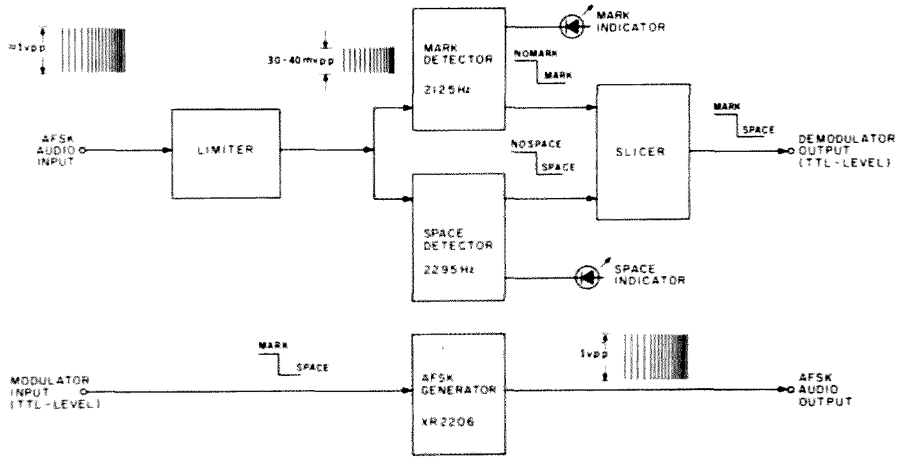


Fig. 1. Block diagram of RTTY modem. Top is demodulator; bottom is modulator.

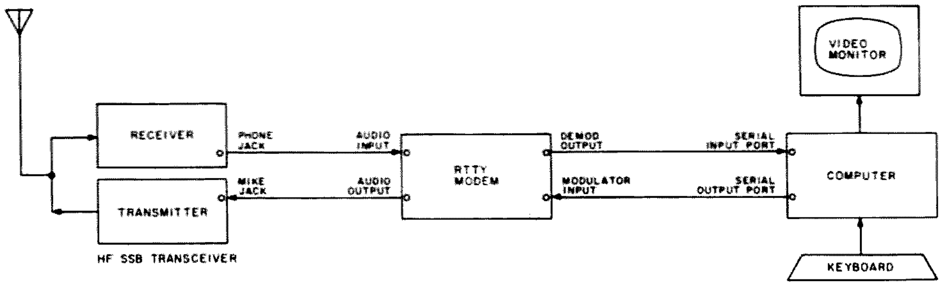


Fig. 2. RTTY modem and computer in an amateur station.

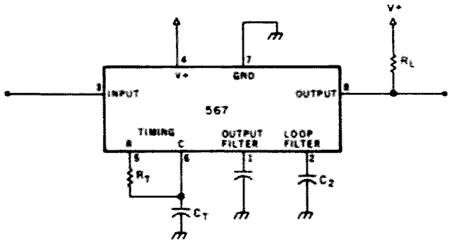


Fig. 3. Basic 567 tone-detection circuit.

Overview

Fig. 1 shows a block diagram of the complete RTTY modem, both the modulator and demodulator.

The modulator generates either mark tones of 2125 Hz or space tones of 2295 Hz, depending upon the value of the keying voltage on its input. The keying input represents serialized Baudot data from an output port on the microcomputer. Each Baudot character is made up of mark and space bits, where a mark is high and a space is low. The output is nearly a pure sine wave, amplitudes of the mark and space tones are equal, and there are no switching transients.

The demodulator portion of the modem consists of a limiter, dual PLL detectors, and a slicer. The limiter controls input level and ensures consistent detector operation. Two independent tone detectors are set to react to the presence of input frequencies on, or very close to, 2125 Hz and 2295 Hz. The passbands are narrow enough to prevent erroneous locking onto nearby QRM and also narrow enough that the two passbands do not overlap. LED indicators attached to each section serve as tuning aids. Alternating flashes indicate a legitimate 170-Hz-shift RTTY signal.

Output from the individual detectors is fed into a slicer. Here the two inputs are combined back into a single output going to the input port on the microcomputer. Again, mark is high, space is low.

Fig. 2 shows how the modem fits into an amateur station.

567 Tone Decoder IC

In order to understand how the RTTY modem works, it is necessary to know a little something more about the 567. Basically, it is a phase-locked-loop tone detector which provides an open-collector output on pin 8 (see Fig. 3). When an input signal is present on pin 3 which falls within its capture passband, the output shorts to ground. Thus, if the output is "pulled up" to 5 volts through an appropriate resistor, R_L (current must be limited to 100 mA or less), TTL-level transitions between 0 and 5 volts can be achieved. External components attached to other pins set center frequency, bandwidth, and output delay.

For the purpose of detecting RTTY signals, we want a center frequency of either 2125 Hz or 2295 Hz. In Fig. 3, R_T and C_T determine center frequency by the approximation: $f_o = 1/(R_T C_T)$.

Now, for RTTY, we want a minimum passband, for two reasons—to eliminate QRM and to prevent detection of both mark and space tones at the same time. Remember, they are only 170 Hz apart. C_2 and input voltage level V_i determine bandwidth. The formula used to approximate bandwidth in terms of percent of f_o is: BW (% of f_o) $= 1070\sqrt{V_i/f_oC_2}$, where C_2 is in μF and V_i is in volts rms.

A word of caution: The formula becomes less usable at lower values of V_i (near 20 mV) combined with values of C_2 below about .5 μF and f_o values in the 2000-3000 Hz range. Actual bandwidth realized is less than predicted by the formula.

The last characteristic of the 567 with which we must be concerned is output delay. All PLLs exhibit some delay to lock onto an input signal and confirm its presence on its output. This is expressed in terms of number of cycles (of input frequency). For 60-wpm RTTY, each bit (a Baudot character is a start bit, five data bits, and a stop bit) is 22 ms wide, except the stop bit which is 31 ms. We therefore want output delay to be something considerably less than 22 ms—which is 46 cycles for a mark bit (.022 sec. × 2125 Hz) and 50 cycles for a space bit (.022 sec. × 2295 Hz).

Unfortunately, output delay is controlled by C_2, and in a way that is opposite to the way it affects bandwidth. In other words, for large values of C_2, bandwidth is small and output delay is large. We would rather have both small. I said earlier, however, that at low input levels and low values of C_2, bandwidth is significantly smaller than predicted by formula—and small output delays are obtained at the same time! This is clearly a case of having your cake and eating it, too.

The circuit described in this article has a measured output delay of about 15 cycles, or about 7 ms. This means that the mark detector, for instance, takes 7 ms to lock onto a 2125-Hz input, resulting in an output which is only 15 ms wide, not 22 ms. If my circuit were of the type that uses only one PLL, the output would be severely distorted. Marks would be too short and spaces would be too long. Using dual detectors with an appropriate slicer eliminates this problem.

Demodulator Circuit Description

Refer to Fig. 4. A jack is provided to attach a speaker for monitoring input audio from your receiver. A switch allows monitoring at attenuated volume, bypassing the attenuator for tuning purposes, or not monitoring at all.

The limiter is a high-gain amplifier using a 741 op amp (U1) which has parallel reversed diodes in its feedback path. The effect of the diodes is to limit output to about .6 volts—the forward-bias drop across a silicon diode. Gain of the amplifier is very high for low-level input, before the diodes begin fully conduct-

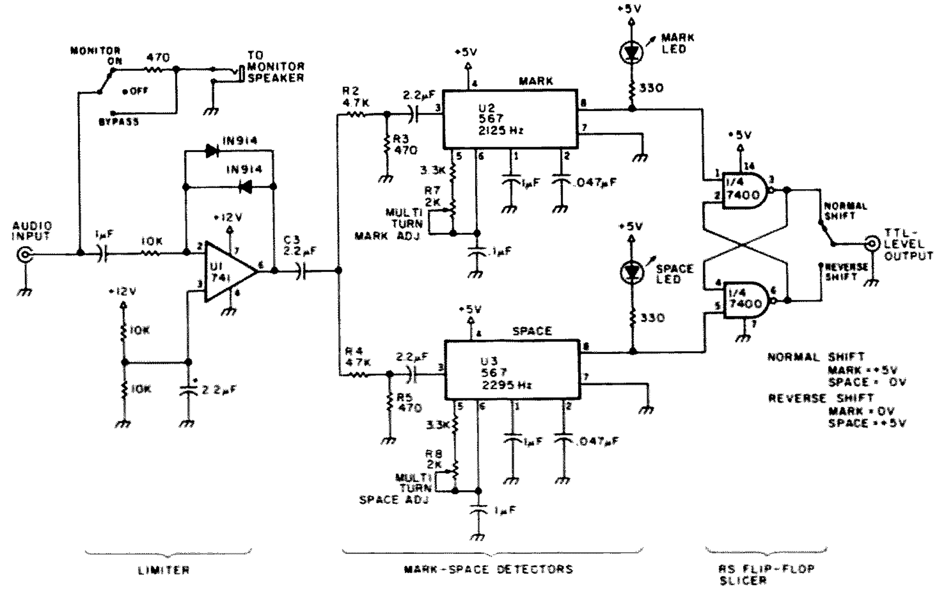


Fig. 4. Demodulator circuit. Audio input is from phone output of receiver. Output goes to computer input port. LEDs indicate RTTY signal.

ing. As input increases, gain decreases logarithmically due to the small-signal conduction characteristics of the diodes. If you look at the limiter output on a scope, you will not see a flat-top square wave, but instead a waveform with more rounded tops. Coupling capacitor C_3 is required to block the dc bias (+ 6 V) on the output of U1.

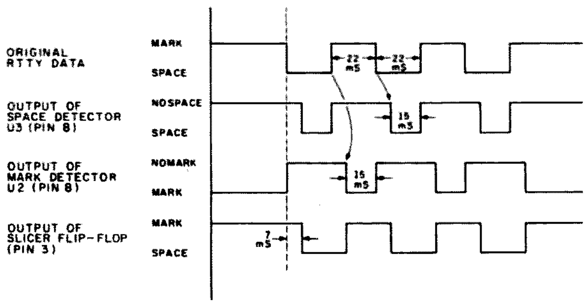


Fig. 5. Slicer reconstructs original data from separate detector outputs. Notice that distortion is corrected and that the ouput signal has been delayed by 7 ms from original.

Limiter output is further reduced by voltage dividers R2-R3 and R4-R5 to approximately 30 mV rms which is used as input to PLLs U2 and U3. This sufficiently low-level input ensures a bandwidth of only about 100 Hz, or ± 50 Hz either side of center frequency. Trimpots R7 and R8 set center frequency.

Output on pin 8 of U2 and U3 falls low when the expected frequency is detected, which turns on the associated LED. I mentioned before that this output contains a 7-ms delay and also has approximately 1 ms of chatter.

These outputs are fed into a slicer which is simply an R-S flip-flop constructed of two NAND gates. Actually, the slicer in this circuit is intended to do more than simply recombine its two inputs into a single output. First, it serves as a debouncing circuit to eliminate the chatter I just mentioned. Secondly, it nullifies the output delays of the PLLs. To illustrate how this works, refer to Fig. 5. Individual output delays of each of the two detectors are shown as being exactly equal when, in reality, they may differ a little. Anyway, the slicer output is almost entirely free of distortion and is delayed in time by 7 ms.

The final advantage of the flip-flop slicer is that it only changes states if both mark and space tones are present. If noise or momentary loss of signal occurs during a single bit, its output state is maintained until the opposite tone is detected. This certainly doesn't solve all types of signal problems, but it helps.

A switch is provided on the output to select normal or reversed shift operation. Most amateurs use normal shift (mark = low tone, space = high tone) and lower sideband on HF RTTY.

Modulator Circuit

Fig. 6 shows the AFSK modulator portion of the RTTY modem. It is based on the XR2206 function generator IC. Although this device has many uses, it is especially designed for two-tone AFSK generation. Read the excellent article by W2FPP for additional information.[2]

Mark and space frequencies are independently set by timing resistor trimpots R9 and R10 respectively. The timing capacitor between pins 5 and 6 is common. Output on pin 2 is a sine wave and is phase-continuous when switching, which makes it well suited for SSB FSK modulation. Component values should be high quality for best results.

The keying signal is applied to pin 9 and is a TTL-level signal directly from the microcomputer output port. + 5 volts selects the mark generator and 0 volts selects space.

Resistor R11 (10k) controls output level. This results in approximately 1 volt pp to the microphone input of the transmitter. Other levels may be obtained by changing this resistor.

The earphone jack was installed so that the output can be monitored for testing purposes.

Power Supply

The power supply is rather straightforward (Fig. 7). The center-tapped transformer serves both the + 5- and + 12-volt supplies. Low current requirements allow the LM340 regulators to be mounted directly to the PC board without heat sinks.

Construction

I built the RTTY modem on a Radio Shack 4½"× 4" universal PC board with a dual 22-pin edge connector and mounted everything into a 3½"× 8"× 6" metal box (see photos) also available from Radio Shack. Fig. 8 shows the component layout and pin allocation that I used. Layout is not critical, which allows a lot of flexibility in how you might build your own version. I intentionally left an area open on the board to give me room to later build a bandpass filter to help reduce QRM problems.

When I decide to build it, I'll just insert it in the circuit ahead of the limiter on the demodulator. The frequency-adjust trimpots for both the modulator and the demodulator are mounted on the board such that they are easily accessible when the board is plugged into the cabinet.

When working with TTL devices, it is normally good practice to add decoupling capacitors between the + 5-V supply pins and ground. Although not shown in the circuit diagram, disc capacitors 0.1 to .01 μF with short leads should be attached to the 7400 (pin 14) and to each of the 567s (pin 4).

Most parts, including the trimmer pots and the XR2206 IC, are available from Jameco Electronics, San Carlos CA 94070.

Alignment

Use a frequency counter to align the AFSK modulator. Attach the counter to the output jack, ground the input jack (or pin 9 of the XR2206) to select the space timing circuit, and then adjust trimmer R10 to get 2295-Hz output. Now remove ground on the input jack (or pin 9) which selects the mark timing circuit, and then set trimmer R9 to get 2125-Hz output. This completes modulator alignment.

Now align the demodulator. First, the mark detector. Apply a 1-V pp 2125-Hz sine wave to the demodulator input jack. I use the frequency marker signal from my transceiver, adjusted to frequency using the frequency counter, and adjusted to level using a scope. Adjust mark trimmer R7 until the mark tone LED indicator comes on. Now find the position which is midway between the two positions where the LED goes off. The center frequency should now be at or very near 2125 Hz. Alignment of the space detector is done in the same manner for a frequency of 2295 Hz.

At this time, you should verify that the bandwidth of each detector is no more than 150 Hz, or ± 75 Hz on either side of center frequency. With your receiver feeding into the input, slowly tune across a heterodyne or marker tone. One of the LEDs should light briefly and then the other. There should be a "dead spot" in between where neither LED is lit. There should not be any time when both LEDs are on for the same tone. If you have problems with these verification tests, check alignment of each detector and check to make sure that the input on pin 3 of each 567 is no more than 30-40 mV pp.

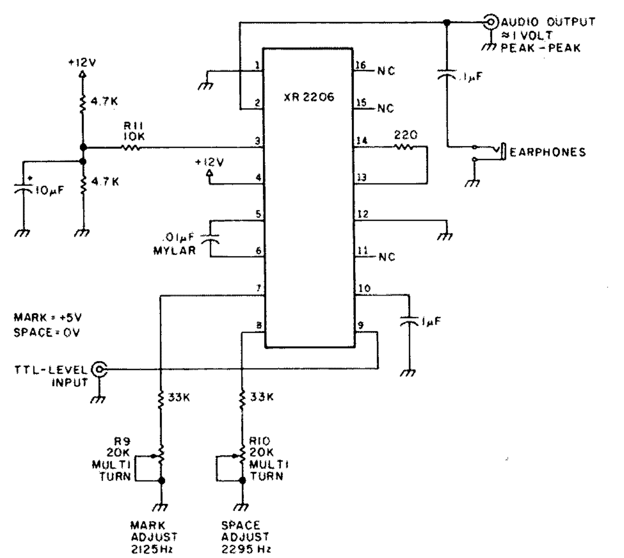


Fig. 6. AFSK modulator circuit. Input comes from computer. AFSK output signal goes to microphone input of SSB transmitter. Earphone jack is for monitoring output.

Operation

Using the modem on the air is pretty simple. When transmitting, the AFSK modulator is driving your transmitter at 100% duty cycle. So make sure that you set your microphone gain for reduced rf power output to protect your finals.

In receive mode, tune your receiver around the RTTY portions of your favorite band and then look for the distinctive blinking of the mark and space LED indicators when a valid RTTY signal is found. Make sure that your receiver's audio output level is sufficiently high to produce good, solid LED flashes. Also, you will usually want the Shift switch in the Normal position.

Summary

The RTTY modem was designed to provide inexpensive yet reliable operation for the amateur who wants to quickly get on AFSK RTTY. Because I wanted to use it with a microcomputer terminal, I attempted to eliminate some of the problems of other designs which were associated with conventional TTY terminal operation. The design is simplified by the use of a single IC modulator and a demodulator based on dual PLL tone decoders. Dual decoders have advantages over designs which use only a single decoder: They are easy to tune, immune to certain types of signal fading, noise, and distortion, and will not react to CW signals.

Although built to interface directly to my computer input/output ports, other types of interfaces, such as RS232C, current loop, or UART, could certainly be used if the appropriate circuitry is added. This makes no difference to

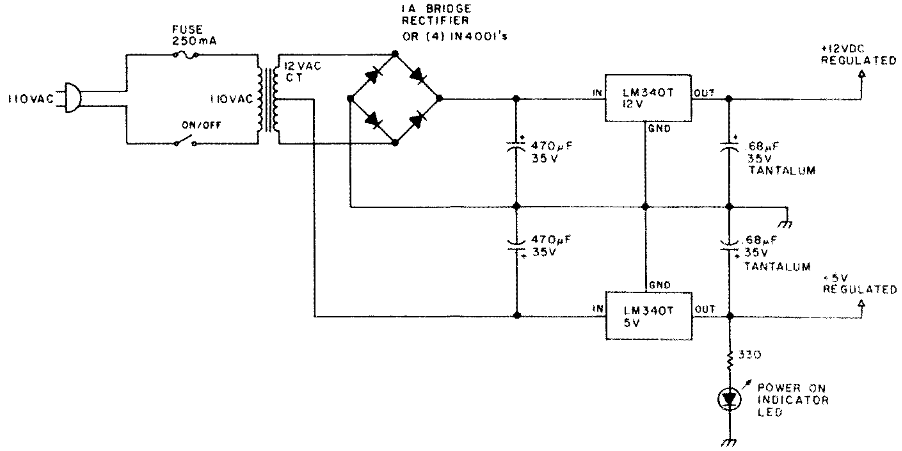


Fig. 7. Power supply. Provides regulated + 5 V and + 12 V.

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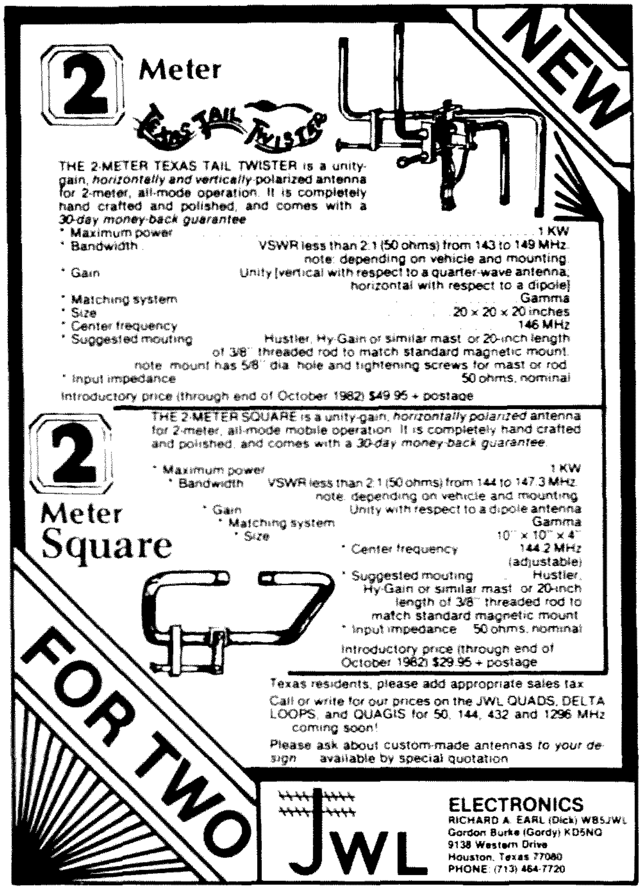


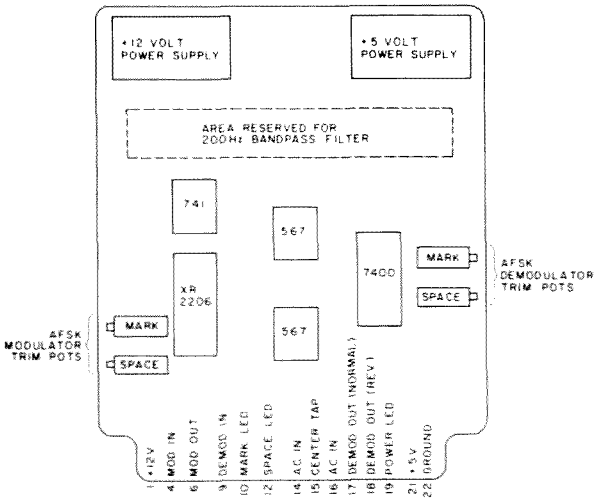


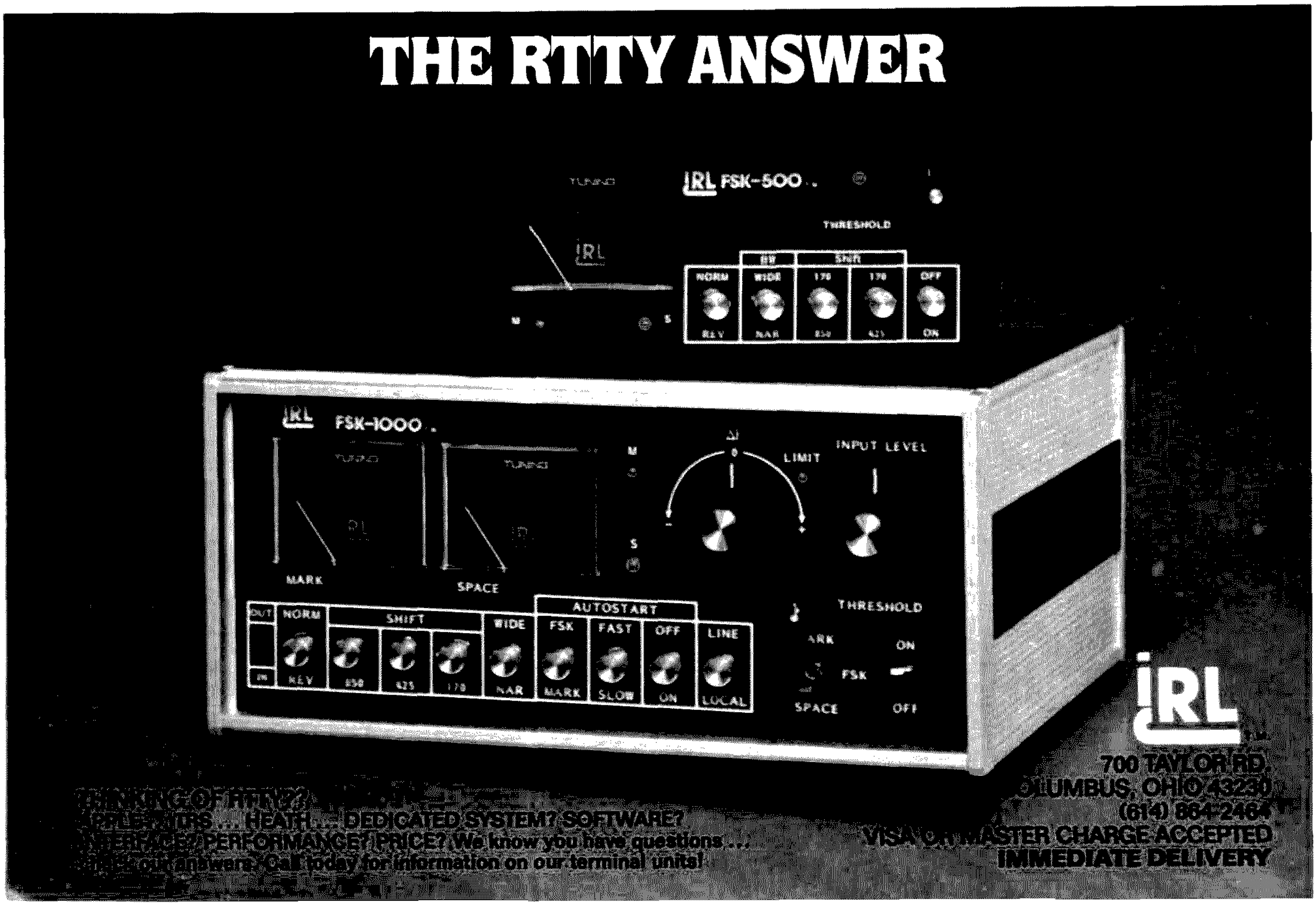
Fig. 8. Parts layout and pin configuration (top view).

the basic operation of the modem.

I wish to thank Bill Harrington WB4PEO for his assistance during the testing phases of this project. ■

References

1. *The New RTTY Handbook*, a *73* publication, 1978.
2. George Allen W2FPP, "Experimenting with Tones," *73*, February, 1979, page 62.
3. John Loughmiller WB9ATW, "Digiratt—RTTY AFSK Generator and Demodulator," *Ham Radio*, September, 1977, page 26.
4. *Linear Data Book*, National Semiconductor Corp., 1976.
5. *73 Magazine*, special RTTY issue, September, 1977.



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6334 Edward Street
Norfolk VA 23513

F1 for the Hot Water 101

—all the way with FSK!

The Heathkit HW-101 is one of the most popular transceivers on the market. It is available for a fraction of the price of some of the fancy rigs, uses tubes, and has plenty of room on the inside for modifications. A comprehensive technical manual comes with it which includes X-ray views of all the boards and a complete explanation of how it goes together—mechanically as well as electrically. Many used HW-101s are available at hamfests and in the various ham magazines. The LMO (vfo) is stable and the rig would seem to be an ideal candidate for RTTY. The only problem is a very limited amount of information about how one might go about putting this jewel on RTTY.

Faced with this dilemma, I decided to grab the bull by the horns and see what could be done. There are two methods of obtaining FSK from a sideband transmitter: 1) the AFSK method and 2) the FSK method.

The AFSK method consists of feeding audio tones into the microphone jack while running the transmitter in the USB or LSB mode. If carrier and unwanted sideband suppression is sufficient, the resulting signal is identical to a true FSK signal when detected on the air. The drawbacks to this method, however, are many. Many transmitters do not have sufficient carrier suppression and it is easy to over-drive the transmitter and cause splattering just as is heard so often on the SSB bands. Another problem is that when using 850-cycle shift, the standard tone of 2975 Hz falls very close to the edge of the audio passband of the transmitter and is therefore attenuated, resulting in uneven power between mark and space tones on the air. Some rigs will not pass this tone at all.

Irv Hoff W6FFC has written several articles explain-

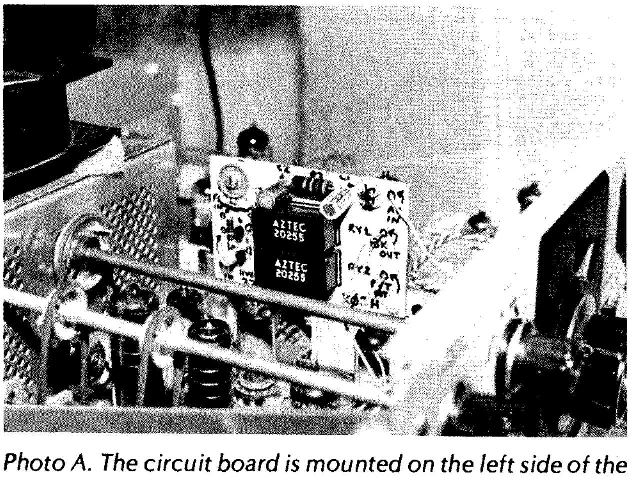

Photo A. The circuit board is mounted on the left side of the LMO. The shift-adjust cap can be seen on the upper left corner of the board.

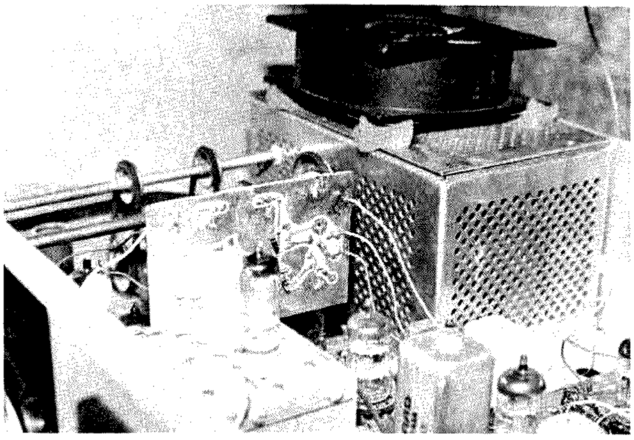

Photo B. Rear view of FSK board showing wires from computer.

ing the pros and cons of using AFSK input to SSB transmitters and transceivers to obtain FSK on HF.[1,2] The instruction manual which comes with the HAL AK-1 AFSK generator has an excellent discussion and summary of the important points. At least one of these sources should be reviewed before attempting to obtain FSK in this manner. Remember, if the FCC detects any unwanted sideband or carrier on your signal, a pink ticket will follow.

The true FSK method is simpler and safer if it can be obtained. Unfortunately, many transmitters have vfo's that are very difficult to modify. Then, too, there is always the possibility of destroying the built-in stability if one tampers with a vfo without sufficient knowledge of the principles involved.

A close examination of the HW-101 schematic shows that in the CW mode, the balanced mixer is unbalanced and a crystal-generated carrier is allowed to pass through. It was a simple matter to connect a trimmer capacitor across this crystal and observe that the desired shift in the carrier frequency occurred.

The circuit of Figs. 1(a) and (b) was developed and has been used at KØJH to work 62 countries and 44 states in two months, running the HW-101 barefoot with only 75 Watts output into a mini-quad antenna on a thirty-foot mast.

The circuit assumes that you are running a computer with TTL output levels. If you have RS-232 output signals, simply add the circuit of Fig. 2 to convert the RS-232 to TTL signal levels. If you are running a normal 120-V-dc 60-mA teletype loop, you can use the circuit of Fig. 3 to obtain a TTL output which will drive the FSK input to the transmitter, but you will have to devise another method of turning the transmitter off and on. Doing it manually would be the easiest method. If any of the TTL signals are inverted, just add a hex inverter such as the 7404.

After trying several solid-state methods with less than complete success, relays were used to do the keying of the transmitter and the switching on and off the air. Perhaps someone else can modify the circuit to accomplish the same thing with a diode or transistor switch and eliminate the relays.

Power to run the relays was borrowed from the filament line which is easily accessible at the pilot lamp socket attached to the LMO. A simple rectifier and filter are used to get approximately 12 V dc. See Fig. 1(c). Relays are miniature magnetic-reed types and are available from two sources that I know of: ETCO 066RL[4] ($.99) and EDLIE DG1407[5] ($.79). Other relays of a similar fast-acting type will work just as well.

The entire circuit is laid out on a printed circuit board in about fifteen minutes using a resist pen. It is not reproduced here because the exact pattern will depend upon the actual components used. Nothing is critical so no special talent is required. There is no reason why wire-wrap or any other method of construction could not be used. The circuit board is mounted to the left side of the LMO, using existing metal screws (see Photos A and B).

The external lines are brought into the HW-101 through a molex® connector (Radio Shack 274-229/239) which fits nicely into the hole provided on the rear panel of the transceiver with a minimum of filing (see Photo C).

The connection to the CW crystal, Y3, is best made at pin 17 of the mode-switch rear wafer. The proper pin can be identified by the black wire which runs from it to a hole labeled "22" on the modulator circuit board right beside crystal Y3.

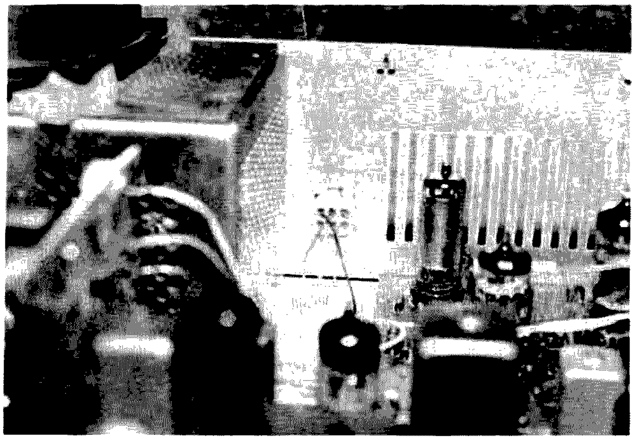

Photo C. The molex® connector (Radio Shack 274-239) is installed on the rear panel.

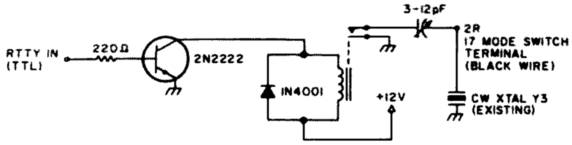

Fig. 1(a).

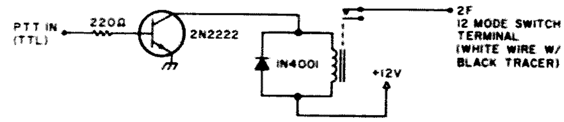

Fig. 1(b).

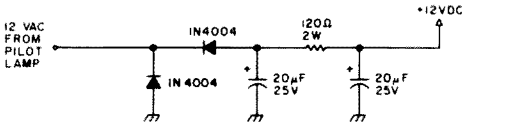

Fig. 1(c).

The connection to the PTT circuit is a little more complicated. The logical place to connect would be on the mode switch at pin 20 or to tube V12, pin 8. The mode-switch pin 20 is not easily accessible, however, and pin 8 of V12 is on the opposite side of the modulator circuit board from the place chosen to mount the FSK board. The point decided upon was the white wire with black tracer which connects to mode-switch pin 20 and then is routed from underneath the mode switch to the rear of that switch. A small piece of the insulation of this wire was carefully scraped away and the PTT connection was made to the wire.

To adjust the FSK circuit for 170-cycle shift, simply put the transmitter in the CW mode and, while connected to a dummy load, key the transmitter through the PTT circuit. Either tune your receiver until the proper mark frequency is obtained as determined by your RTTY terminal unit or, using a frequency counter, adjust the receiver until an audio output frequency of

2125 Hz is obtained. Now set the equipment to send a steady space or open your loop if using a high-level (120-V-dc, 60-mA) loop, and adjust the trimmer capacitor for a proper space as seen at the terminal unit or until the frequency counter indicates a frequency of 2295 Hz. (2295 − 2125 = 170-Hz shift.)

Provisions in this circuit are for 170-Hz shift only since nearly 100 percent of ham and MARS activity is now using that shift. If you need 850-Hz shift for some reason, simply add another trimmer capacitor in parallel with the existing one, arrange to switch it in for 850-Hz shift, and adjust it until 850-Hz shift is obtained (2975 Hz).

Now tune the HW-101 up in the CW mode as you usually would, but decrease the output power to around 60 Watts by backing off on the mic/CW level control. If you have the 400-Hz filter installed, be sure the filter control is in the SSB position. If you have not done so, you will soon see the need for VE3IOI's sidetone volume control modification.[3] Without some method of controlling the sidetone, you will be subjected to a piercing tone during the entire time the HW-101 is transmitting RTTY.

If you have never been on RTTY before, you are in for a treat. There isn't another mode which affords the quality QSOs that RTTY does. Everybody wants to chew the rag, even the DX stations in most cases. The average QSO lasts for an hour. You will also be amazed at the really good signals you will hear from stations who are running anywhere from 10 to 100 Watts. Probably 60 to 70 percent of all RTTY signals are being originated from transmitters putting out less than 100 Watts. One chap in Italy called me for a signal report and when I gave him an honest 589, he explained it was his first RTTY QSO using his new TS-130V which puts out 15 Watts. The HW-101 is a high-power rig by comparison. Try it—it's a ball.■

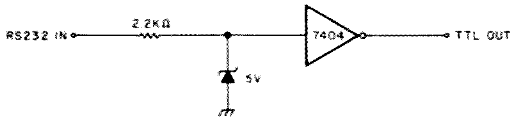

Fig. 2.

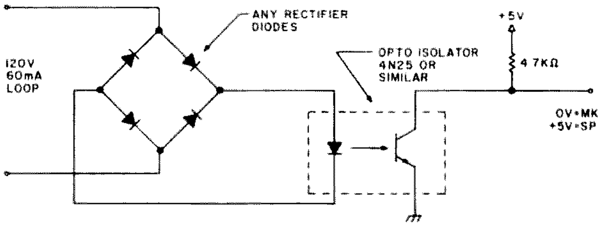

Fig. 3. High-level RTTY loop to TTL.

Notes

1. "AFSK for RTTY," Irv Hoff W8KDC, *QST*, June, 1965, page 32.
2. "AFSK for RTTY," Irv Hoff W6KKC, *QST*, February, 1969, page 11.
3. "Sidetone Volume Control for the HW-101," Hints and Kinks, *QST*, June, 1981, page 36.
4. ETCO Electronics Corp., North Country Shopping Center, Rte. 9N, Plattsburgh NY 12901 ($10 minimum order).
5. EDLIE Electronics, 2700 Hempstead Turnpike, Levittown NY 11756 ($22.50 minimum order).

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Yup. Here's another article on radioteletype, folks. But before you turn the page with one hand (while stifling a yawn with the other), consider the following. I've got somewhat less than $200 invested in my RTTY gear and I'm not only going to show *you* how to do likewise, but I'll even give you a few pointers on how to hook all these weird gizmos together. The result? Loads of fun with no muss, no fuss.

Photos by Forest McCarty

Photo A. On the left is the Model 19 printer, with the Model 14 tape reperforator to the right. The sour look on my face is representative of how you will feel after lifting your first printer! But remember, the price is right.

What you *won't* find in this article is a lot of complicated math or any incredibly-expensive equipment. Don't look for any computer programs and don't expect a long list of formulas or incomprehensible graphs. Just pay attention to the pictures, chum, and enjoy the thrill of RTTY as much as a growing number of us are doing now. Got yourself positioned in your favorite chair? Super. Here goes.

First off, I'll make a couple of basic assumptions that should apply to you and your station. Assumption number one is that you presently have a transmitter/receiver (or a transceiver) lurking about somewhere and some sort of wire, aluminum tubing, or whatever that you can press into service as an antenna. Nothing fancy, mind you. If it had to be fancy, I wouldn't be writing about it! Anyone with the misfortune of having visited my shack will jump at the opportunity to verify that my antennas are among the worst possible. So whether your goal is HF or VHF RTTY, do what you can. One of my favorite sayings is that *any* antenna will work—but some do so better than others . . .

The second assumption is that you have a desire to become active in RTTY. Perhaps you have friends who consistently time out the local repeater with details about their latest zillion-dollar efforts at computerized transmission of the Miss April centerfold. Or maybe your programmable scanner locked itself up solid on 147.1 MHz the other night with those weird deedle-deedle-deedles that you'd just love to snoop in on. OK, OK—just hang in there for a few more para-

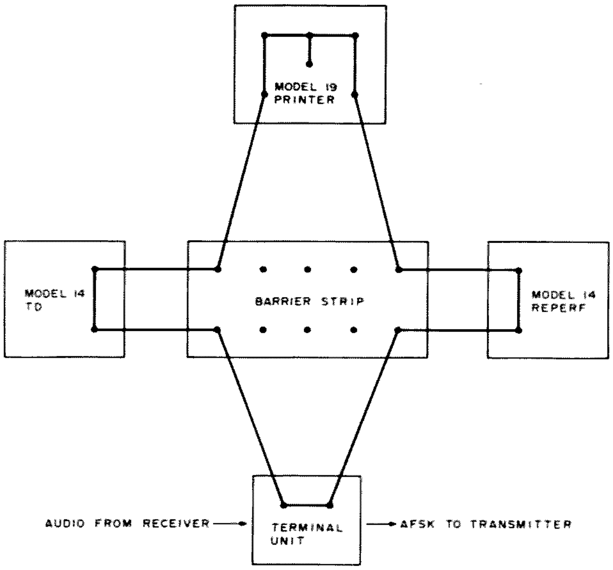

Fig. 1. The "local loop" is nothing more than a dc loop of 60 mA connecting all of the RTTY station equipment. The use of a large barrier strip allows for additional pieces of equipment to be inserted into the loop with ease.

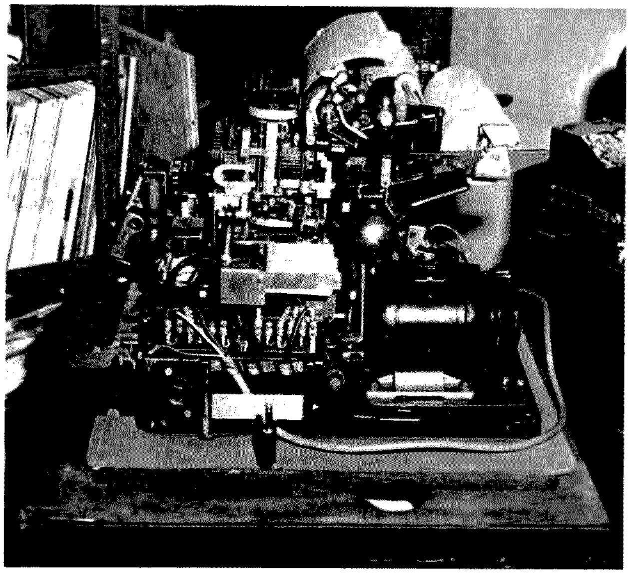

Photo B. The Model 19 printer with cover removed. Note the terminal strips with all the wires going every which way. Don't be intimidated! Only two sets of connections are really necessary, one for the ac and one for the dc loop. See Fig. 1 for loop details. Also note use of ¼-inch phone plugs for easy changes in equipment location.

graphs and you'll be able to further your studies into human anatomy and/or the fine points of RTTY espionage!

The above assumptions are probably valid for the huge majority of you who have gotten this far into the article. And, let's face it, the theory hasn't become too deep yet, and you've not spent a dime.

Photo A shows yours truly and my mechanical marvels. They're marvelous for two reasons. First, they're older than I am, while probably working as well as the day they were built. And second, they were free! This particular Model 19 and all the associated tape gear was obtained gratis through the Army MARS program. Not that I'm suggesting that you join one of your state MARS teams just to get free equipment, but it certainly is one of the benefits that one hates to pass up, and you'll learn a lot if you participate in MARS.

I'd also like to point out that in the past year, five complete teleprinters have passed through my hands at no charge. Two were from the MARS program and three were from fellows who were glad to get them out of their shacks! Their loss was my gain, and there's absolutely no reason why you can't do the same. Spread the word on the repeaters, request help from your friends, write letters. Do anything reasonable, but keep at it. There's more free equipment out there than you'd dream possible. I've had to drive from where I live in the mountains of the Shenandoah Valley all the way into the suburbs of Washington DC more than once—a distance of about 100 miles each way. There are only a couple of reasons I'd drive there these days, and one is free RTTY gear!

Assuming that you've rounded up one or two of these fine old machines, now's the time to hook up your terminal unit.

"What's a terminal unit?" you ask in dismay! Well, without going into detail, the terminal unit (or TU) is that neat little gizmo that converts those deedle-deedles into something that your RTTY machine can use. There's a great profusion of TU equipment advertised these days, but if you'll take a glance at the accompanying photos you'll see the one I've been using. It's the TU-170, made by Flesher Corp., and their advertising is abundant in *73* as well as other magazines. In kit form the TU-170 was $150, and let me tell you, pal, if *I* can build it, *you* sure as heck can. Honest.

This particular TU has many features, including a gadget that will allow you to transmit RTTY as well as just print it. Also, it has an autostart feature which will allow you to receive RTTY

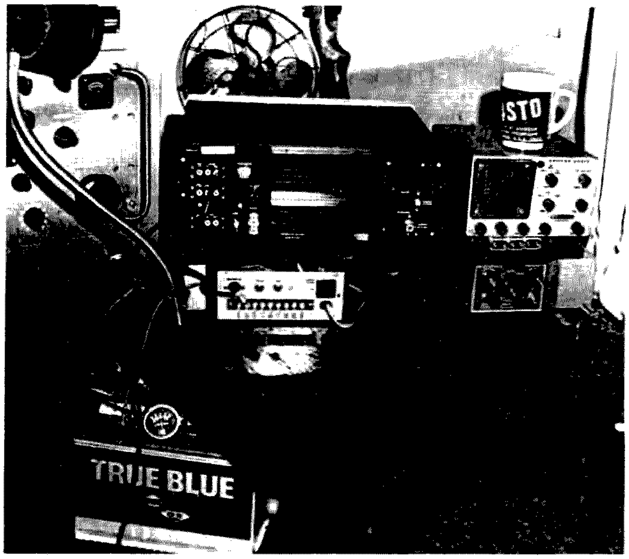

Photo C. The only interconnection between the transceiver and the terminal unit required for receiving RTTY is from the "patch out" jack to the "receiver audio" lugs on the TU. The printer is normally plugged into the ac receptacle on the TU for autostart operation.

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messages while you're at work. But the nicest thing I'd like to pass along to you is that the people at Flesher are just as interested in getting your TU to work as you are. I've had to pull them away from whatever they were doing on several occasions on the telephone and they were *always* extremely helpful. I wrote and told 'em so, too. You wouldn't believe the foolish questions I've had to ask them, but they never flinched. Thanks, folks!

OK, now you've got your RTTY machine and you've got a TU and you're standing around wondering how in Sam Hill to begin hooking all this gadgetry together. Relax! Better yet, don't relax. Jump right up and run over to your collection of back issues of *73*. The September, 1977, issue is crammed full of much-needed information on the care and feeding of these old clunkers. What's that you say? Those nerds who've been running their mouths on the repeater refuse to give back your copy of the September issue? Never fear. Wayne Green sells back issues, and if he's all out, see if you can get an SASE into my mailbox and I'll try to answer your questions.

At any rate, take a peek at the accompanying closeup of the Model 19 printer (Photo B). This particular machine really had me buffaloed for an embarrassing number of weeks. I'd found several articles and books that told me how to hook up a normal printer (which has three terminal strips), but not a word about this particular beast. One of my MARS friends finally said, "Hey dummy! All they've done is combine the three normal strips into two," which explained why all my gyrations in the shack failed to produce the third strip from within the innards of this antique. You might be lucky enough to have the red and black plugs already there, just-a-waitin' to be hooked *in series* with your TU loop supply (see Fig. 1). If not, you may have to dig around a bit. If nobody has seriously butchered the internal wiring, you'll find the correct connnections with no problems. If you really get stuck, let me know.

One brief word of warning here. Keep your mitts away from the actual loop supply. I'm talking about something like 130 volts at 60 mA. That just might be enough to kill you! I've managed to ignore this advice thrice so far, and *it hurts!*

Now apply audio from your rig to your TU, and you should be able to tune in RTTY signals. Photo C shows how I managed my connections. It took about thirty seconds to figure this part out. The thrill of tuning past a RTTY signal and hearing the printer start chugging away was just super. I couldn't believe that this ancient equipment could possibly work so well! Given a bit of lubrication and a dab of TLC, I expect that these machines will live longer than I will, particularly if I ignore the previous paragraph another time or so!

Photo D shows how I managed to start transmitting. It was very difficult—I merely plugged in the AFSK output from my TU to the mike jack on my transceiver, adjusted the drive, and started typing!

I do, however, feel a touch of moral obligation to the RTTY neophyte. If you're using tubes in the finals of your rig, for Pete's sake, turn down the mike gain or otherwise reduce the power! I've ruined more 6146 finals than I'd care to comment on, and I've gone now to idiot-proof transistors. The rig that I presently use is capable of running all day at full power. Yours might not be so blessed. Find out, if you don't already know. End of sermon.

I've shown you my method for getting on RTTY. This is one of the simplest and cheapest ways I could come up with to obtain the features that I deemed important. I've got loads of ideas brewing in my head that I'm hoping to write about soon, so feel free to write and tell me what you liked or didn't like about this article. All SASEs will be answered.

I would like to express my sincere appreciation to Forest McCarty for his photographical expertise, as well as to Durwood WA4ZBP and all my many Virginia Army MARS friends for answering my never-ending questions. ■

Photo D. Transmitting RTTY is simplicity itself. Just plug the AFSK output from the TU into the mike jack of the transceiver, and enjoy!

Phil Anderson W0XI
3005 West 19th
Lawrence KS 66044

Incredibly Simple RTTY

—receive it on your TRS-80

If you have a transceiver and a TRS-80™, then you have nearly all the equipment necessary to receive radioteletype (RTTY). The only additions required are a 26-statement BASIC program, two TTL integrated-circuit chips, and a demodulator. The program and interface design are presented here, and a demodulator is recommended.

RTTY System

As shown in Fig. 1, a RTTY system might consist of a radio receiver, a demodulator, a computer (in that case, the TRS-80), and a monitor or other form of readout. Most RTTY is sent as audio frequency shift keying (AFSK) via SSB radiotelephony. Hence, when a signal is tuned in on your receiver, it will be heard as two alternating audio tones. Those tones are called the mark and the space—the lower tone being the mark.

The job of the demodulator is to convert those audio tones into a computer-compatible on-off signal. Historically, demodulators have developed a 20-milliamp current signal for direct use with a teletype terminal such as an ASR-33. However, for interconnection to a computer, the demodulator, or demod, must present a logic signal that is compatible with standard logic chips. So, when the AFSK signal is received, the demod converts the lower tone to a logic one and the upper tone to a logic zero or zero volts.

The computer's job, then, is to convert the logic signal from the demod to a corresponding letter code for presentation on a monitor. The majority of the work is done with a BASIC program while the interface provides connection to the demodulator output.

Demodulation

Let's take a look at the demod operation first. Suppose the letter Y is being received. A low audio tone will be received first followed by the start bit, a higher frequency tone. The demod will convert the low tone into a logic high signal, or mark, and the start bit into a logic low signal, or space, at zero volts. The actual code for the letter Y, as shown in Fig. 2, is then received as a sequence of marks and spaces: mark-space-mark-space-mark or high-low-high-low-high. The sequence is ended by a stop bit—a mark. All marks and spaces are 22 ms in duration except the stop which is 31 ms.

For testing of the TRS-80

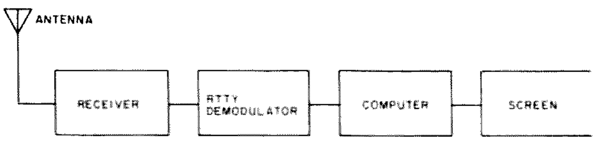

Fig. 1. RTTY reception system.

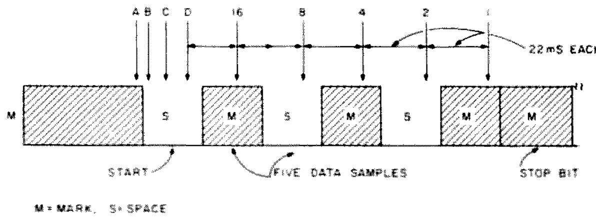

Fig. 2. RTTY signal from demodulator.

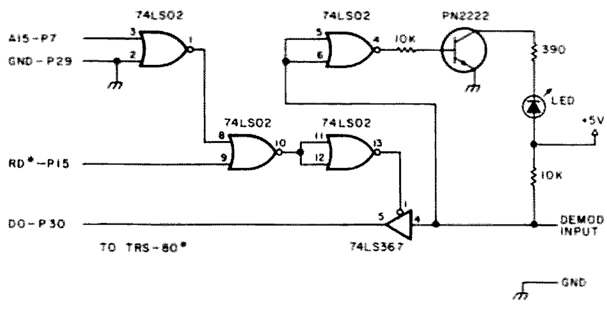

Fig. 3. TRS-80/RTTY interface.

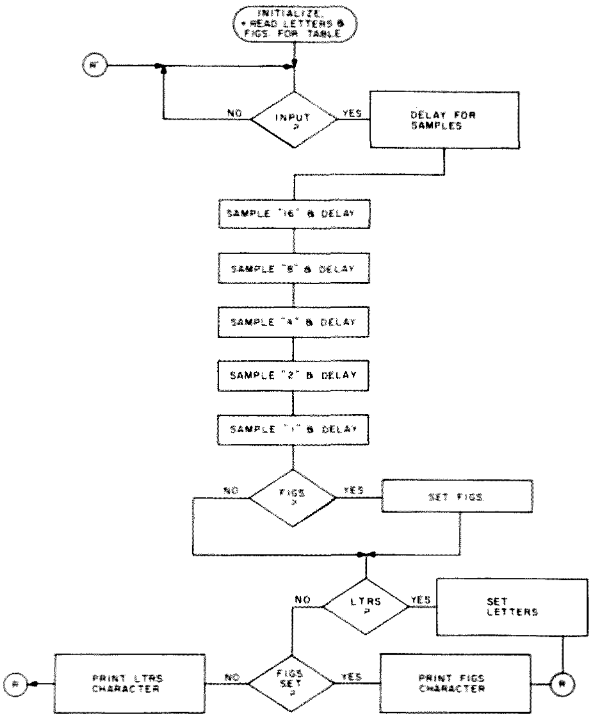

Fig. 4. Flowchart for the RTTY program for the TRS-80.

```
10 CLS:DIMA $(32):A$(Ø)=" ":REM TELETYPE RECEIVER PROGRAM
15 DIMB$(32):B$(Ø)=" ":M=Ø
2Ø REM FOR KANTRONICS' SIGNAL ENFORCER,11-2-8Ø, WØXI.
45 DATA K,Q,U,#,J,W,A,X,F,Y,S,B,D,Z,E,V,C,P,I,G,R,L
46 DATA *,M,N,H," ",O,*,T,*:B=Ø
47 FOR I=1TO31:READ A$(I):NEXT I
5Ø DATA (,1,7, ,',2,-,/,!,6, ,?,$,',3,-,*,Ø,8,&,4,)
51 DATA *,.,-,#," ",9,*,5,*
55 FOR I=1TO31:READ B$(I):NEXT I
1ØØ IF PEEK (-1)=254 THEN 11Ø ELSE 1ØØ
11Ø I=Ø:J=Ø:K=Ø
115 FOR L=1TO4:NEXT L
12Ø IF PEEK (-1)=254 I=I+16 ELSE I=I+Ø
125 J=J+Ø:K=K+Ø
13Ø IF PEEK (-1)=254 1=I+8 ELSE I=I+Ø
135 J=J+Ø:K=K+Ø
14Ø IF PEEK (-1)=254 I=I+4 ELSE I=I+Ø
145 J=J+Ø:K=K+Ø
15Ø IF PEEK (-1)=254 I=I+2 ELSE I=I+Ø
155 J=J+Ø:K=K+Ø
16Ø IF PEEK (-1)=254 I=I+1 ELSE I=I+Ø
17Ø IF I=4 M=1
172 IF I=Ø THEN 2ØØ
18Ø IF M=Ø PRINT A$(I); ELSE PRINT B$(I);
19Ø GOTO1ØØ
2ØØ M=Ø:GOTO1ØØ
```

Fig. 5. 26-step RTTY program listing.

RTTY system, the Kantronics Signal Enforcer™ audio filter was used. That dual filter has a TTL-compatible demod output. When a signal is tuned in, the Signal Enforcer demod output presents a logic high signal for a mark and a logic low signal for a space.

Now let's examine how the demod output can be interfaced to the TRS-80 hardware.

Computer Interface

Since the RTTY signal is only one voltage, either high or low as time goes by, only one signal line into the computer is necessary. However, in order for the TRS-80 to receive it, the signal must be gated onto the memory bus under the control of a "read" signal. In addition, the memory bus must be isolated from outside circuits, so a noninverting TTL logic chip is required.

As shown in Fig. 3, these requirements can be satisfied using two chips, a 74LS02 NOR gate and a 74LS367 gated buffer. The demod output status is transmitted to the memory bus via the buffer when pin 1 is set to a logic low. That is accomplished by executing the BASIC statement A = PEEK(−1). The minus factor sets the highest-order address bit of the address bus on, and the PEEK statement causes the "read" pulse to be issued simultaneously. The address bit is inverted by a NOR gate and then combined with the "read" pulse to provide the activating signal at pin 1 of the buffer.

The resulting data, then read off the memory bus, is inverted and assigned to the variable A. For example, if the demod output is high, the value for A will be 255, but if it is low, it will be set to 254.

A few more comments on the logic interface are in order. The line names at the left of Fig. 3 represent the pin connections to the TRS-80 I/O port. A15-P7 means address line 15 at pin 7; D0-P30 means data line 0 at pin 30; RD*-P15 means read pulse negative at pin 15; the ground connection is at pin 29. The user must supply his own 5-V-dc power source for the interface logic because the TRS-80 connector usually has that pin disconnected. In addition, if desired, the remaining NOR of the 74LS02 can be used to buffer the demod input and drive on the LED.

That completes the interfacing. Let's now take a look at the 26-statement BASIC program to decode and display RTTY signals.

BASIC RTTY Program

Again, take a look at Fig. 2. The standard RTTY 60 format includes a start bit of 22-ms duration, five 22-ms data slots, and a 31-ms stop bit. When no characters are being received, the demod output will be high continuously. When a letter or figure is received, it will commence with a start space. This is our key; we will have the program watch the demod output until a space is received. Then, proper delays can be built into the program so that samples are taken at approximately the center of each data slot.

For example, if a space is detected at B in Fig. 2, then the program will delay 22 ms and sample at 16, delay again for 22 ms and sample at 8, and so on, taking five samples in all.

Now let's take a look at the flowchart for the program as shown in Fig. 4. First, constants are initialized and letters and figures are read in via the data statements to form the RTTY character codes. Then, the program enters a continuous loop. If a space is received, proper delays are generated and samples are taken. If not, the pro-

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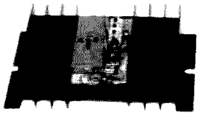

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Tom W6ORG Maryann WB6YSS

gram waits, continually sampling for an input. Once a sample is taken, the program must check to see if the figures or the letters code has been transmitted. Those codes are used to set lower- or uppercase letters or figures, for those characters to follow.

Now let's take a look at the program listing.

26-Statement BASIC Program

As shown in Fig. 5, the program is short—26 steps. It is probably possible to shorten it somewhat by combining some statements.

Statements 10 through 55 initialize constants and set the string variables with index numbers in two tables. Those indexed variables represent the letters and figures that can be printed by a Teletype™ machine. Statement 100 is used to continually sample for a start bit. Once one is detected, statements 110 through 160 sample a five-bit code. Statements 170 through 200 determine letters or figures states. For a TRS-80 Level II with 16K, statement pairs 120, 125 or 130, 135 will cause a delay of about 22 ms. Some adjustment may be necessary from machine to machine.

To summarize, let's suppose the letter Y is to be received. The program is started and waits at statement 100 for a space or start bit. Suppose one is received as at B in Fig. 2. The program then delays about 8 ms at statement 115 and then samples at 16, 8, 4, 2, and 1. With the code Y, a space is received at 8 and 2. That totals 10 and is used as the index to A$(10) so that Y may be printed on the screen.

73 and we hope you enjoy listening to RTTY.■

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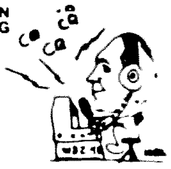

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The RTTY/Tribander Marriage

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It seems that almost all electronic gear today is rated in terms of a duty cycle, which simply means how long or how hard it can work without resting and cooling off. In the days of AM when all transmitters and rf amplifiers were expected to operate under full power for long periods of time, we didn't give much thought to a duty cycle. True, perhaps some of the cheaper gear should have had such ratings because, as we all know, heat is the archenemy of electronic components, and much of the more lightly built stuff had frequent component failures.

Today, however, duty cycle is a big thing. Our gear is tiny indeed when compared to yesteryear's. Miniaturization is the thing. Solid-state technology has pygmytized those old boat anchors into neat little packages hardly larger than yesterday's external vfos. It has given us features few dreamed of twenty or thirty years ago when the names Johnson, B & W, Hallicrafters, and Collins, among others, were the respected leaders in manufacturing amateur radio equipment.

In many cases, these little runts even give us far more power output than their ancient counterparts. But there is one marked difference: They can't do it continuously.

And this duty cycle thing isn't limited to exciters and amplifiers. Many antennas also have duty-cycle ratings, although I can't recall any manufacturer saying so in black and white. Instead, they use terms like "...rated for full legal amateur power limit" or "...rated at 2-kW (or 4-kW) PEP."

Well, this sounds impressive, but when a body strips it down to its basics, it really doesn't say anything worthwhile. In the first place, PEP refers to SSB *input* power, not *output*. Some loosely apply the term PEP when talking about CW, which is neither here nor there. The power we should be concerned with—as long as we don't exceed the legal input limits—is that which runs up the feedline and makes a noise on the air. And believe me, this is always a whole lot less than what we're stuffing *into* the final!

Of course, manufacturers' power ratings usually apply to trapped antennas. But let's take the old familiar yagi tribander. I think almost anyone reading this will agree that these are by far the most popular HF antennas in the world and, with a very few exceptions, all have traps of varying design. They usually aren't as efficient on any one band as a monobander, but they serve well and allow flexibility with minimum expense and hassle, and we've been getting along with them for a long, long time.

And their physical designs have changed over the years. These new ones have sleek, compact trap assemblies with the coils enclosed in aluminum tubing, away from the elements and offering much less wind resistance than those old external coils we used to see. One of the main reasons they can do this is because AM on the ham bands is a thing to be discussed with nostalgia. Hardly anyone ever throws a kilowatt of plate-modulated power on the air any more, so the traps don't have to be so massive.

SSB and CW are intermittent, right? Therefore, the traps aren't called upon to perform under sustained high rf voltages, so now they can be made of aluminum wire-wrapped on injection-molded plastic coil forms and sealed inside aluminum housings. Neat. Very neat and efficient.

It has been said by wise men that about the only thing in this old world which remains constant is change. It's called progress, and thank goodness for it. But progress is not achieved totally without difficulties, as we shall see.

Amateur radioteletype and amateur television have been around for quite some time, but not until the last couple of years have they enjoyed much widespread popularity. Now, with the rapid advancements in solid-state technology bringing microprocessors and home computers within reach of the modestly-heeled amateur, one has only to tune across the bands and listen to the *deedle-deedle* of RTTY or the musical whirring of an SSTV rig to realize just how many hams have turned to these "new" and fascinating modes of communication. And interest is growing daily, judging by the number of manufacturers who advertise sophisticated RTTY and SSTV equipment in the pages of radio amateur magazines.

However, there begins to emerge a new problem. RTTY and SSTV have little in common with SSB or CW. Rather, they are first cousins to FM. To transmit in either mode demands that a steady carrier be placed on the air, and therein lies a problem which is causing growing concern among the

manufacturers of multiband trapped antennas. Therein also lies the reason for this article. I hope that in sharing my own experience with fellow amateurs, I might help in some way to minimize, or even in some instances eliminate, upcoming problems. On the other hand, it is not my intention to single out any one manufacturer and add insult to injury by naming a product because, from what I have been told by manufacturers and amateurs alike, more than one manufacturer is hunting a solution.

In my own case, in March of 1979 I bought and installed a three-element triband beam made by one of the oldest and most respected manufacturers in the business, and it performed better than expected. Much of my operating time is spent on 20-meter RTTY, however, and a great deal of that is spent in running pictures. This is a blast, as any pix enthusiast will tell you. It is astounding to see the skill and ingenuity that has gone into the making of some of these and a thrill to watch one taking shape on the printer.

There are a few pictures around that take ten minutes or less to send, but there also are hundreds which take up to half an hour or even longer, all requiring a steady, unwavering carrier being fed into the antenna.

It is in this kind of service that the real weakness shows up in our new equipment. Few of today's transceivers are capable of much rf output under steady key-down operation because they are designed for intermittent use. The plate dissipation of the final tubes (or transistors), as well as the limitations of power supplies, must be taken into consideration and not exceeded. I run a Kenwood TS-820S, and the owner's manual plainly states that it is unwise to exceed 100-Watts input to the final in RTTY or SSTV modes; so I don't. But on 20 meters this produces an output of less than 25 Watts. And while this power level will get you by under good band conditions, it becomes pretty puny while trying to run a picture on 20 during crowded weekends. So the next thing, naturally, is to run an amplifier.

But even here there are limitations. First, many amplifiers, such as Heath's SB-220, should be allowed to cool after 10 minutes operation at 1 kW. They tell you so. But then, how many exciters are there around that will drive it to a full gallon? Not many, for they take lots of drive—on the order of 50 to 100 Watts, which means *output* from the exciter. So, in the case of the SB-220, you get about ten times the power out that goes in, or, typically, 250 Watts out with 20 or so Watts drive, which doesn't strain anything very much and is adequate for most RTTY or SSTV work.

Then another problem rears its ugly head. The summer of 1980 was a particularly warm one, and one day my swr rose far above the usual 1.2:1 at around 14.090. This was after I had again become the owner of a 1957-vintage Johnson Viking Kilowatt, the one that is contained in a beautiful gray steel desk. I had owned this very same rig between 1959 and 1965 before selling it to KØJTZ. He trucked it all over the country for 15 years, then moved back here and resold it to me. Since this jewel requires so very little drive, it is the ideal amplifier for RTTY and SSTV. Ten Watts will drive it to 2-kW PEP, so one can see how little strain there is on the TS-820S.

Well, I had been using this Johnson for about a week when my swr began to climb. True, there had been times when, in order to get a RTTY picture through heavy QRM on 20, I had run the power up near a kW, which put about 600 Watts into the beam. This was the beam's undoing, for one glance at it showed the 3-foot section outboard of the trap on the driven element was sagging about two inches. This was on just one end. Obviously, something had melted inside the trap.

Fortunately, it is no big hassle to climb the tower and remove the driven element, letting it down with a rope. And when I got it down and the trap disassembled, I found the plastic coil form melted like butter.

This beam has two coils inside the trap assembly. The inboard coil is the ten-meter trap while the outboard is for fifteen meters. Together, they form the 20-meter trap. It was the fifteen-meter trap that had melted, and inspection of the other trap showed it had split slightly and shrunk 3/16" in length, indicating imminent failure.

A letter and an order to the factory for new fifteen-meter traps brought a telephone call from the manufacturer. He was very nice and understandably very concerned. He said this certainly was not the first trap failure in his product, that it had been going on for well over a year and was due to RTTY and SSTV operation. He added that other manufacturers also were plagued with the same problem and all were trying to find a solution.

"These antennas have a duty cycle," he said. "They were never meant to take a steady carrier for long periods of time. The heat generated in the trap coils has no place to go, so the plastic melts. Power level is not the problem. It's a matter of duty cycle. No matter if you run high or low power, if you keep running RTTY with that beam, the traps eventually will fail. High power, of course, will do it quicker."

"I didn't see any mention of 'duty cycle' in your ads," I said.

"When the antenna was designed," he answered, "we had SSB and CW in mind, and the traps will handle the legal limit in those modes for years. But we didn't anticipate the sudden popularity of RTTY and SSTV."

He went on to say that they had hand-made some coil forms from Teflon™ which gave no signs of failing, but said their molds used for plastic would not accept Teflon, and retooling would be too expensive and run the production costs too high.

"How about drilling ventilation holes in the trap housings?" I asked.

"It would help," he admitted. "But we already have two small drain holes in the bottoms, and insects even find their way inside these. Then, when the rf starts, they can't get out. They become fried, and the resulting carbon buildup eventually shorts out the turns on the coils."

Stumped, that's what I was. Here I had a fairly expensive tribander sitting atop a 50-foot tower, and I wasn't about to give up my RTTY. There had to be a way, I told myself. There just *had* to be!

Having been in aviation more than 40 years, I was aware of the value of air-cooling, so I decided to ventilate the traps. Leaving a 3-inch strip on top of the aluminum housings untouched, I drew lines ¾" apart lengthwise on the rest of the surfaces. Then I marked them every ¾". Alternate lines were stagger-marked so the holes would likewise be staggered diag-

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onally and would not structurally weaken the housings. After that, I center-punched each mark and, in three succeeding steps, drilled holes, the last drill being ½" in diameter. When I finished, the aluminum housings closely resembled the barrel housings on those World War I German Spandau machine guns. Each contained 94 holes, which would allow a considerable airflow around the coils.

Following this, using ordinary aluminum screen-door wire, I wrapped each completely, securing it in place with four stainless-steel hose clamps. The idea here was to defeat all but the tiniest of insects, as well as snow and ice, while still allowing warm air from the traps to escape. The screen impairs the flow-through of air, but everything nowadays is a compromise, isn't it? And with no holes on top to allow snow or rain to enter, I felt the coils were reasonably safe from the elements.

At any rate, for the past nine months or so I have been running from 200 to 600 Watts into that beam on RTTY, and during some pretty warm weather, I might add. So yesterday, out of curiosity, I took the element down and inspected the traps. I could find no evidence of cracking or melting, which seems to indicate that the ventilation system is working. This may not be the ultimate answer, but it certainly has to be an improvement for those RTTY and SSTV operators who are using a trapped tri-band beam. They already have their investment in both beam and equipment and, according to a popular manufacturer, are headed for eventual trap failure. So why not take this simple preventive measure? ■

The Sweet Sounding Repeater

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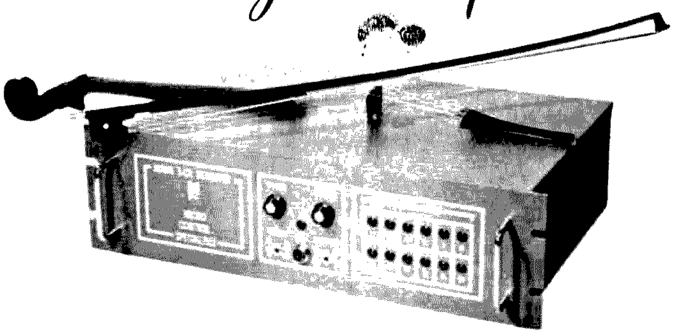

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Confessions of a Counter Evolutionary

—part II

Editor's Note: 73 presents the second hall of WA2FPT's "Confessions of a Counter Evolutionary." The August, 1982, issue featured the first half of this comprehensive design. The LSI Computer Systems LS7030 counter chip used in this project is available from Belco Electronics, 43 South 49th Ave., Bellwood IL 60104, for $12.75 plus shipping.

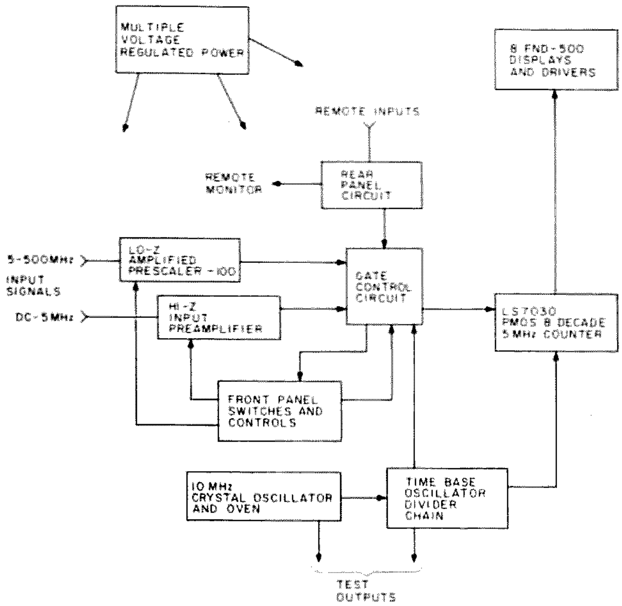

Fig. 1. Block diagram.

Last month we tackled the basic theory of counters and scrutinized the timebase, display, and counting circuitry. We'll finish the job this month. Let's start by looking at the front panel.

There is a conspicuous absence of rotary switches on the front panel. Instead, simple binary counters stepped with momentary-push-button SPDT switches are used with LED indicators to control all counter operations.

There are three such binary "rotary switch eliminators" employed: a four-position circuit for the four timebases (.01, .1, 1, and 10 seconds), a three-position input-display-select button for kHz, MHz, and prescaled MHz, and a mode-select switch for frequency, period, and events. Two additional push-button-switch circuits are enabled when in events mode and the lamp test, which was explained earlier.

The basis for these three counters is the four-position timebase-section counter of Fig. 12. The two 2-input NAND gates form a set-reset flip-flop that debounces the SPDT switch contacts, giving clean, glitch-free pulses to step the binary counter. Notice that the counters, 4013 dual-D flip-flops, are wired as toggles. That is, the outputs alternate low and high with each positive transition of the input clock

pulse. Two such arrangements are cascaded, resulting in a counter with four distinct output combinations. The output sequence of the four consecutive pushes of the timebase select button, taking the Q_1 and Q_2 outputs in pairs, is: 0,0, 1,0, 0,1, and 1,1, where 0 is almost GND and 1 is near +5 volts.

74C02 quad 2-input NOR gates are used as "zero-detecting" decoders to give unique 1 output levels for each of the four pairs of outputs. NOR gates can be used this way because they produce a high output only if all inputs are low. These decoded signals then control the selection and routing of the timebase signals. Fig. 12 shows the four timebases as inputs to the four NAND gates of IC16.

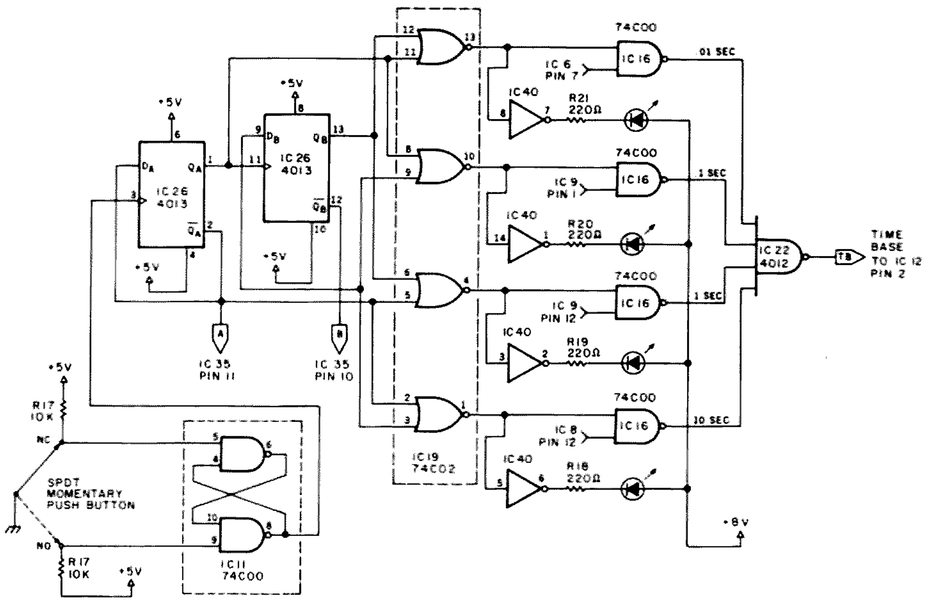

Fig. 12. Timebase select.

The output of each of these NAND gates is regulated by the condition of its control line, the four counter states, only one of which will be active (high) at a time. Therefore, only one of the four NAND gates will be passing pulses, with the remaining three outputs disabled at a high level. As the timebase button is pushed, the counter will step, activating the next control line, gating (enabling) the next corresponding timebase. All four timebases feed a 4012 (IC22) to give a single source of timebase outputs.

This kind of arrangement amounts to a 4-to-1 multiplexer, but I didn't have the one chip package available to do the job, a 4052.

Four jumbo LED front-panel indicator lights show which timebase is active. The control lines from IC19 accomplish this by turning on gates of IC40, a 75492 LED driver. Series resistors limit the current for the LED's safety. Since I ran the LEDs on 8 volts, I used quarter-Watt, 220-Ohm resistors that let about 30 mA flow through the LEDs.

All the resistors are mounted in DIP component carriers occupying sockets on the main wire-wrapped board. I'll admit this was an unnecessary extravagance, but they were a gift to my parts cabinet, so I used them.

The chosen timebase signal emerges from pin 1 of IC22 and goes to IC12, pin 2, the 74C157, where it is selected, or not, for frequency, or else disconnected for the other functions.

The input-display-select switch selects kHz or MHz readout of the displays. The third position, prescaled MHz, routes only signals from the 500-MHz amplified prescaler to the 7030 counter, again with the proper display.

Because only three positions are required, the basic four-position counter is modified to reset to the first position after stepping past the third state. This is done by using the output of the NOR gate decoding the fourth position of the counter to reset the counter to 0 by taking advantage of the 4013's direct (asynchronous) reset input. Whenever those inputs (pins 4 and 10 for both halves of a 4013) are brought high, the flip-flops set their Q outputs to 0, regardless of any other interval activity. The basic scheme in Fig. 13 is thus the same as in Fig. 12.

As explained before, IC11 is a set-reset flip-flop; IC33, a 4013, is the counter; the state decoders are a 74C02; and the display LEDs are driven from 75492 gates. Notice the labels on the 74C02 output lines—they are all important in controlling the various counter functions and we'll see more of them later.

The mode-select switch shown in Fig. 14 is a mirror image of the input-display select. The modes, as you probably have surmised by now, are frequency, period, and events. The period control line, labeled P, serves as the select line for IC12, the 74C157 that interchanges the period and the timebase.

The E line (for Events) has a little more work to do, however. Recall that our events totalizing needs the reset and load signals withheld from the 7030. What is required is a circuit that, upon user demand, will allow manual loading and resetting, but will default to the automatic supply of reset and load pulses to the 7030 chip as needed in period and frequency operation. The E line is the key to such control in this counter.

There are two front-panel push-buttons named display start-stop and count-reset that drive the circuit in Fig. 15. IC28 debounces both, and IC37 provides push-on, push-off toggling action. That is, each Q output from IC37 is latched at alternating 0s and 1s by the configuration shown. In effect, each is a single-pole, double-throw switch. The first push can set the flip-flop (output high), and the next push would reset it. Notice how the E line, inverted through a gate of IC24, only enables these flip-flops when in the events mode. Otherwise, the flip-flops are always set.

The direct reset or clear inputs are wired through two SPDT-switched rear-panel RCA phono jacks. This gives some external device a chance to reset and load the counter, if desired.

Remember the RC networks used to provide reset and load pulses? Well, each of these enters a separate AND gate, whose outputs finally go to the 7030 reset

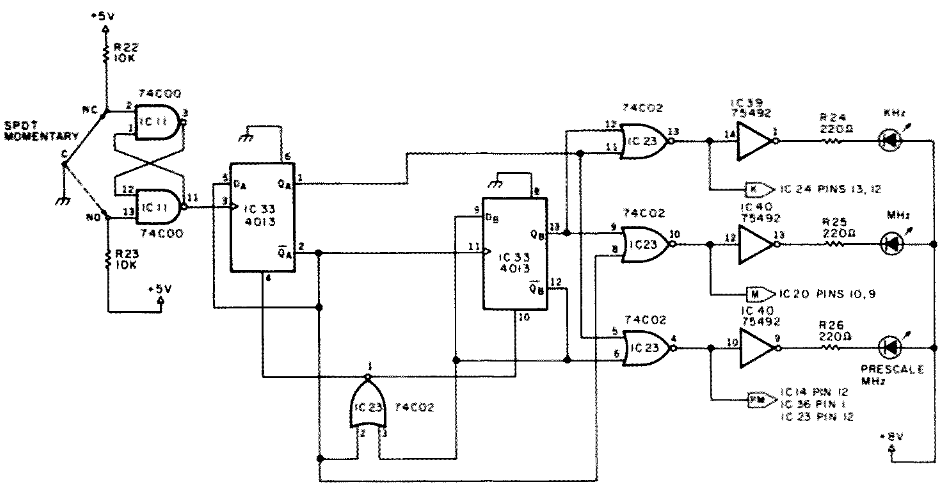

Fig. 13. Input display select.

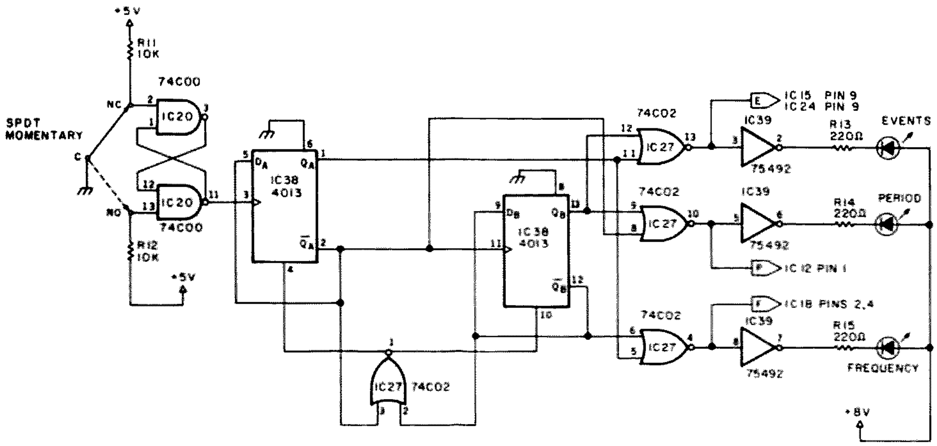

Fig. 14. Mode selection.

(pin 22) and load (pin 21) inputs. The AND gate also squares up the exponentially-rising input pulses nicely.

The utility and simplicity of the reset and load functions should relieve any misgiving you might harbor concerning the slight circuit complexity. As long as frequency or period mode is selected, IC37 remains set and the two AND gates of IC18 shown are always allowing the load and reset pulses to pass through to the counter.

When events mode is selected, the **E** line goes high, and the gate synchronizing flip-flop of IC13 is set via pin 4. IC15, pin 9 also is tied to the **E** line, preventing normal reset pulses. Simultaneously, the two halves of IC37 are enabled, and the display start-stop and count-reset push-buttons are active. IC18, pins 10 and 13 will not now pulse, because no pulse will reach either of the load or reset RC networks. See Fig. 11(a). Accordingly, the push-buttons so described will have complete and total control over the machine's resets and loads.

In the events mode, the display will be rippling with input counts, be static, or display zero. If it is rippling, the display start-stop is always delivering a load to the counter, and the count-reset button is telling the counter to count! (That is, *not* reset.) A push of the display start-stop button will freeze the display (no more load), but the 7030 still will be counting internally. Another touch of the DSS button will again provide a continuous display of the incoming events. As soon as the C-R button is pushed, the counter will reset internal circuits to zero. In order to view this zero, the DDS must be active; otherwise, the previous reading will be seen.

Making the internal 7030 counter controls separate from the display allows complete flexibility for elapsed-time operation and data-acquisition applications. The remote-control option multiplies the value of this feature.

Decimal Pointers

The decimal point changes positions, as you would expect, with kHz or MHz selection, and with the selection of each of the four timebases. It also offsets two places to the right to indicate proper MHz when the divide-by-100 decimal point also becomes visible only in frequency mode, because the period displays in microseconds and the events mode doesn't need it.

There was a good reason to save the description of the decimal-point circuitry until now, because its design is wholly dependent on two characteristics of this counter: the multiplexed display and the binary counters used in the function switching.

From the 7030 data sheet, I learned that in order to illuminate, for example, the decimal point in the fifth digit, the digit 5 strobe would have to be routed to both the decimal point input at pin 10 of the 7030 (to unblank the display) and to a suitable decimal point driver (a 75491). Four different timebases with the three different frequency representations give twelve switching combinations.

This challenge (for me, anyway) was simplified considerably by using two CMOS multiplexer chips, the now-familiar 74C157 quad 2-to-1, and the 74C151 8-to-1 multiplexer. If you have never played with multiplexer chips, you'll be in for a pleasant surprise when you see how this and similar switching problems are solved.

The four timebases are 10, 1, 0.1, and 0.01 seconds. For a proper readout in MHz, the decimal points to be activated must be the 8, 7, 6, and 5 digit strobes, respectively. A kHz readout requires digit strobes 5, 4, 3, and 2. The prescaled MHz display needs the strobe pulses for digits 6, 5, 4, and 3 for the different timebase.

Most of the work is handled by the 74C151. Eight

digit strobes: 8, 7, 6, 5, 5 (again), 4, 3, and 2, are selected by a 3-bit address called C, B, and A. The high order bit is C. Using the input-display-select line, this is 0 for kHz and 1 for MHz (really *not* kHz). The B and A digits are the timebase-select outputs (Q_1 and Q_2) of the 4013 flip-flops.

The prescaled MHz decimal point placement requires a modified input of the digit strobes for the MHz section of the 74C151. Here the 74C157 is used to select either strobes 8, 7, 6, and 5, for normal MHz, or 6, 5, 4, and 3, for the prescaled MHz display. As you might guess, the PM (Prescaled MHz) control line, when active, selects the B-side strobes.

The complete decimal point circuit is shown in Fig. 16. The four high-order strobes to the 74C151 are selected by the 74C157, with the lowest group of four appearing as direct inputs for the kilohertz presentation.

As the 74C151 is addressed by the two output bits from the timebase select counter, the chosen digit strobe is sent out via the Y output (pin 5) to the data input of IC31, a 4013 flip-flop. IC35 can also be enabled by a separate strobe line itself, but here the outputs are always enabled by grounding pin 7. At IC31, the selected digit strobe is clocked by a 100-kHz signal through the AND gate of IC18, enabled by control line F (Frequency mode). The Q output sends the strobe, as mentioned earlier, to the 7030 decimal-point input at pin 10, and to the 75491 driver to the decimal point segments of the display. The leftover portion of IC22 is shown wired as an inverter to take the blank signal from the 7030 (pin 11) and properly reset IC3, preventing possible display damage. The 100-kHz clocking signal is more than adequate to accurately follow the 1-kHz scanning rate.

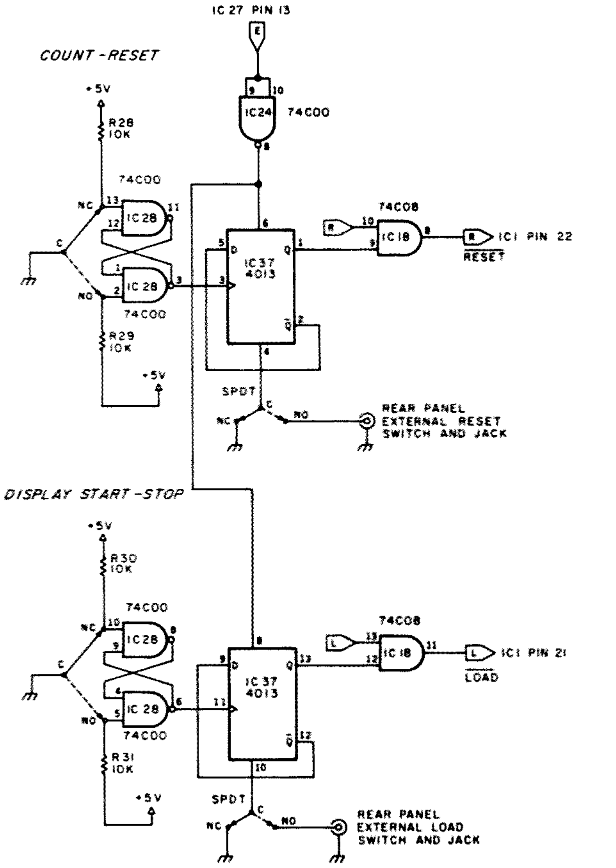

Fig. 15. Count-reset and display start-stop.

Another feature is that leading zero blanking is automatic when the decimal point is not used.

It might be helpful to remember that the digit strobe selection given here is for right-hand decimal-point displays. Left-hand decimal-point displays would use strobes 1-7 and 2-8.

Front Ends and Odds

The input-signal conditioner, so well-loved and remembered from Elementary Counting, is manifested in a Hi-Z dc 5-MHz preamp, and a 5-500+-MHz Lo-Z divide-by-100 prescaler amplifier.

The Hi-Z unit (see Fig. 17) also was borrowed from WA1UFE's fine counter article in the December, 1976, *73 Magazine*. The only change I made was to omit the 68-pF silver mica capacitor shunting the 100k input resistor. Since the preamp is used only to 5 MHz, or so, this "speed-up cap" was not needed. Besides, I didn't have one in my junk box!

The same fine performance noted by WA1UFE still holds for my rendition of this excellent design. I do have something to contribute, however. An easy PC-board layout using tape is shown in Fig. 18(a), full-sized, with foil and component sides illustrated.

The Lo-Z 5-500-MHz preamp is also easily done with the "tape 'n etch" method of PC-board fabrication. Fig. 20(a) gives the pattern for the board layout, while Fig. 19 shows the schematic. The basic design is from K4GOK, with some later embellishments by K4JIU in the February, 1978, issue of *Ham Radio*. My sole contribution, aside from the PC board, is the 39-Ohm emitter resistor in place of the earlier 47-Ohm one. This increases the current through the 2N5179 and lowers the input impedance a bit, but significantly improves the low end (5-10 MHz) sensitivity.

The 11C90 ECL prescaler is no longer a stranger to experimenters, so it will not be elaborated on. (See the article by K2OAW in the October, 1976, *73* if you want some good 11C90 information.) Although the 11C90's price has dropped somewhat, I was still nervous, after soldering it in place, to apply power.

The 74196 divides the 11C90's pin 7 divide-by-ten output by 10 again, giving a divide-by-100 output. The output taken is the Q_C output from pin 2 instead of the usual pin 12 Q_D output commonly employed. The frequency is the same from each, but the Q_C output has a 60% duty cycle compared with the 90% Q_D duty cycle. This is done for the benefit of the 7030, which, from its data sheet, prefers as close to a 50% duty cycle as possible. It is only towards the operational limits of any device, including the 7030, that details such as this become important. Experience is a thorough, if humbling, teacher. . .

Both preamp boards are mounted by small right-angle brackets inside a small aluminum minibox (the 3 × 2 × 1¾-inch Bud Z100). UG-290 BNC connectors are used for the inputs, and their bolts hold the preamp box securely. I can't say for certain whether or not these shielding precautions are absolutely required, but there is no false triggering from strong nearby rf energy, either. Small-diameter coax (RG-174/U or similar) is used to bring both boards' outputs to the PC-board edge connector.

These TTL signals are converted into CMOS signals by a neat trick peculiar to CMOS. CMOS inputs are not directly connected to the outputs. Also, inputs can be paralleled for increased fan-in (the maximum number of allowable inputs), and the

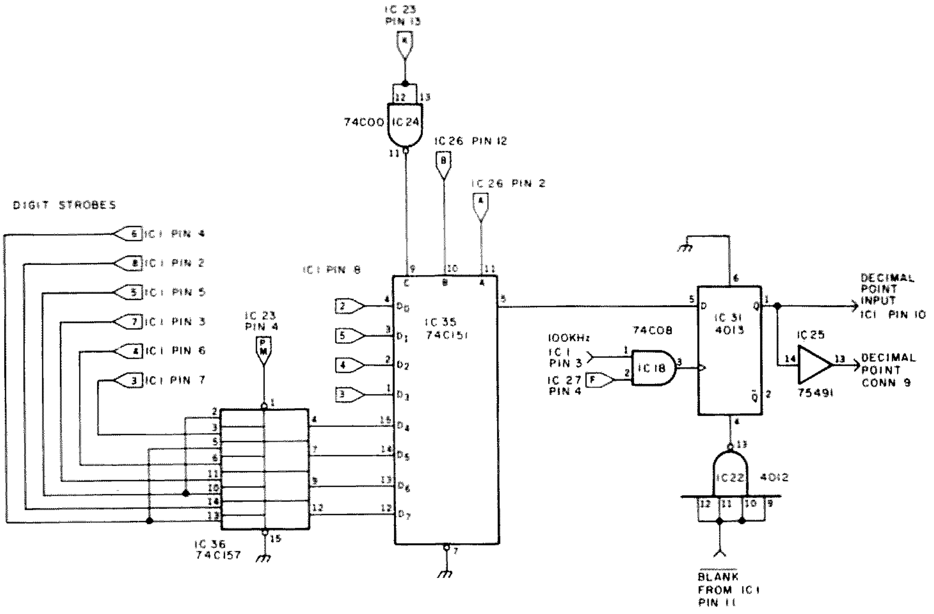

Fig. 16. Decimal point.

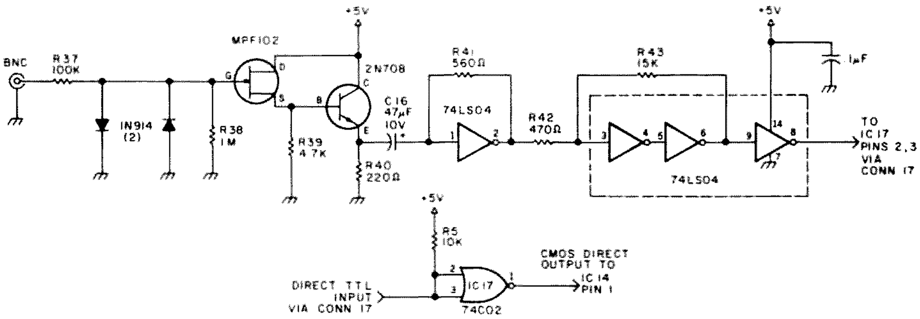

Fig. 17. Hi-Z dc to 5-MHz input preamplifier.

outputs for increased fan-out (the output load-driving capability).

The 74C02, IC17, is an example of how this CMOS quad 2-input NOR is put to work as a TTL-to-CMOS converter. Even though its physical location is on the main wire-wrapped board, it is shown in the front-end schematics of Fig. 17 and Fig. 19.

The output of the Hi-Z unit, a 74LS04 of modest power requirements, is converted to CMOS compatibility by a single NOR gate with two inputs tied together with a 10k-Ohm pull-up resistor to help the TTL 1 output up to a comfortable CMOS level.

Fig. 19 shows the remaining three 2-input NOR gates used to interface the Lo-Z preamp with the CMOS main counter circuitry, with all inputs and outputs in parallel. Try this with something other than CMOS logic! Such an arrangement provides needed buffering for the power-hungry 74196 output transistors.

Sensitivities for the Lo-Z unit are adequate between 5 and 10 MHz, becoming terrific out to the limits of my stone-age rf generator. With graphs and numbers aside, though, it's a real kick to stand 25 feet away from the counter and read those half-inch digits as I key my 1-Watt, 2-meter FM transceiver.

The Hi-Z unit exhibits a usable sensitivity of about 45 mV at the low audio range, down to about 10 mV to its externally imposed 5-MHz limit, as closely as I can determine from basement measurements.

Power Play

Power supplies are usually the most boring part of any project, thanks to the voltage regulator integrated circuit manufacturers. I suppose this machine is no exception, but I did have some surprises during construction.

There are three 3-terminal regulators used, two 7805s and one LM340T-8, as can be seen from Fig. 21. One 7805 (+5 volts) is housed inside the box containing the

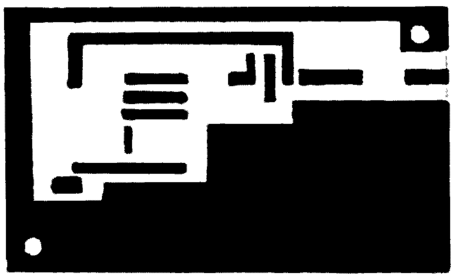

Fig. 18(a). Hi-Z preamp PC layout.

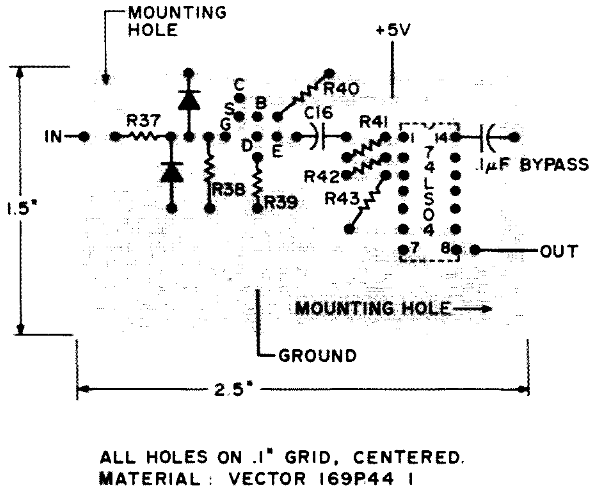

Fig. 18(b). Parts placement for Hi-Z preamp PC layout.

front-end boards, and the TO-220 package is bolted to the aluminum case. Total power drawn for the front end is about 200 mA, most of which is eaten up by the Lo-Z board, as you might imagine, with its 11C90 and 74196.

The entire counter board, with the exception of the 75492s, is powered from the other 7805 and draws a scant 150 mA at 5 MHz. Yet CMOS has the rather nice property of using power only when it switches on or off, and practically zilch when static. Of course, the higher the frequency of switching, the greater the power consumption.

The LED indicators and the FND 500 seven-segment display drivers are driven from the LM340T-8, an 8-volt regulator used to brighten the front panel a bit. Both the 8-volt and 5-volt regulators are heatsinked (sunk?) by being bolted to the L bracket holding the 44-pin edge connector.

Back in the discussion on the master oscillator, the 723 regulator was explained, so I won't subject you to it again! The experience with the crystal oven does merit a few observations, however. The oven draws 750-800 mA at 9 volts. I had originally used a 5-volt LM309K raised by a 1.1k resistor "pedestal" (between the case common and the circuit ground) to 8 + volts. This was all mounted on the master-oscillator board inside the minibox.

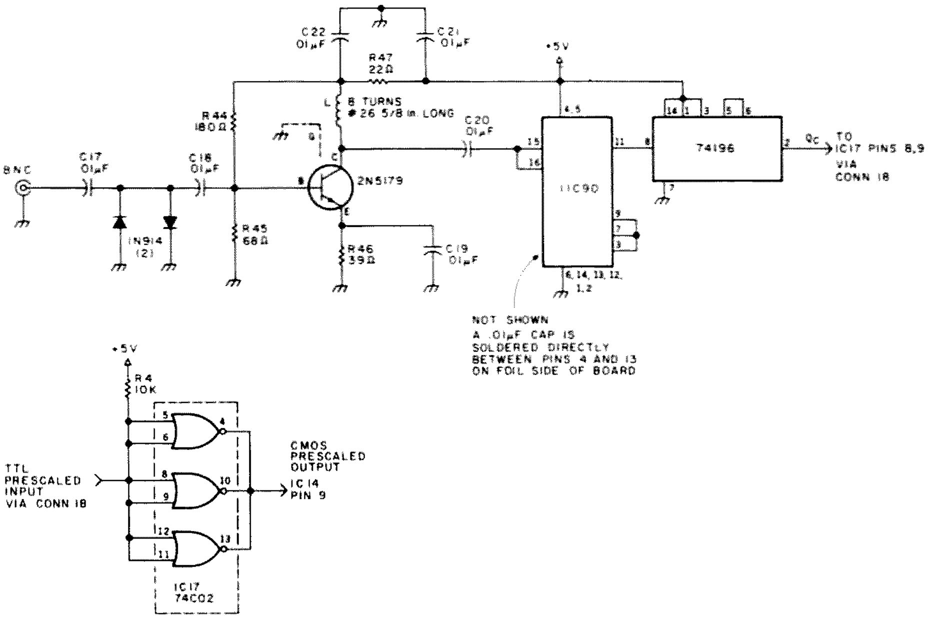

Fig. 19. Lo-Z 5-500-MHz input amplified prescaler (÷100).

Out on the bench in free air, it worked great. Buttoned up, however, the oven would cease to function after a few minutes. After a little careful thought along with my consternation, I figured out that the 309 was entering its thermal-shutdown mode because I had neglected to properly heatsink it. The air circulation in the haywired stage of the design had lulled me into a false confidence that "everything would be cool" once it was inside the minibox.

After ripping this failure out, I solved the whole problem with a single resistor, a capacitor, and Ohm's law. The raw dc from the full-wave rectifier was about 12 volts. Since the oven operates at 9 volts, I needed the value of resistor that would drop about three volts when the oven kicked in.

Ohm's law, assuming a 12-volt supply and a current of 750 mA, gave a 4-Ohm resistor value (3-volt drop = 750 mA × 4 Ohms) to produce the desired 9 volts for the oven. When the oven was off, the unloaded circuit voltage would climb back up to 12 volts, but that didn't matter.

I had a 5-Ohm resistor handy so it was tried, with success, even though the oven voltage was just a little over 8 volts. A 10-Watt resistor hardly gets warm, and a 5-Watt would probably be fine. The capacitor smooths the ripple resulting from the extra load on the transformer when the oven is operating. A front-panel LED turns on with the oven to show when the oven is active.

The 7030, being a good PMOS device, requires a negative bias when interfacing with TTL and CMOS. I used the brute force method of a separate transformer and a half-wave rectified 12-V zener diode to supply it with −12 V. Because only a few mA are drawn, however, virtually any arrangement that will provide a −12-V bias would work here.

At one point during the breadboarding stage, I was using a zener-biased pass-

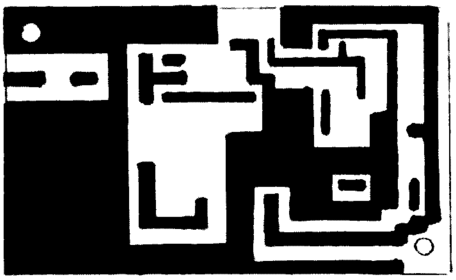
Fig. 20(a). Lo-Z prescaler (÷100) PC layout.

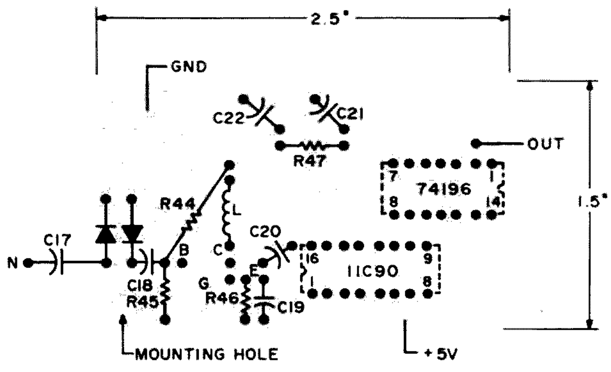

Fig. 20(b). Parts placement for Lo-Z prescaler (÷100) PC layout.

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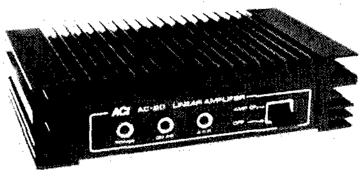

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Independent Dot & Dash (Full) Weighting	Yes	Yes	Yes
Calibrated Speed, 1 WPM Resolution	Yes	Yes	Yes
Calibrated Beacon Mode	Yes	N/A	No
Repeat Message Mode	Yes	N/A	Yes
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Instant Start From Memory	Yes	N/A	Yes
Message Editing	Yes	N/A	Yes
Automatic Stepped Variable Speed	No	No	Yes
2 Presettable Speeds, Instant Recall	No	No	Yes
Automatic Trainer Speed Increase	Yes	Yes	N/A
Five Letter or Random Word Length	Yes	Yes	N/A
Test Mode With Answers	Yes	Yes	N/A
Random Practice Mode	Yes	Yes	N/A
Standard Letters, Numbers, Punctuation	Yes	Yes	N/A
All Morse Characters	Yes	Yes	N/A

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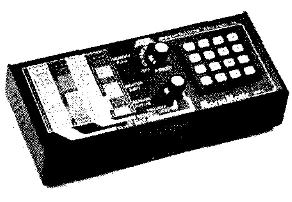

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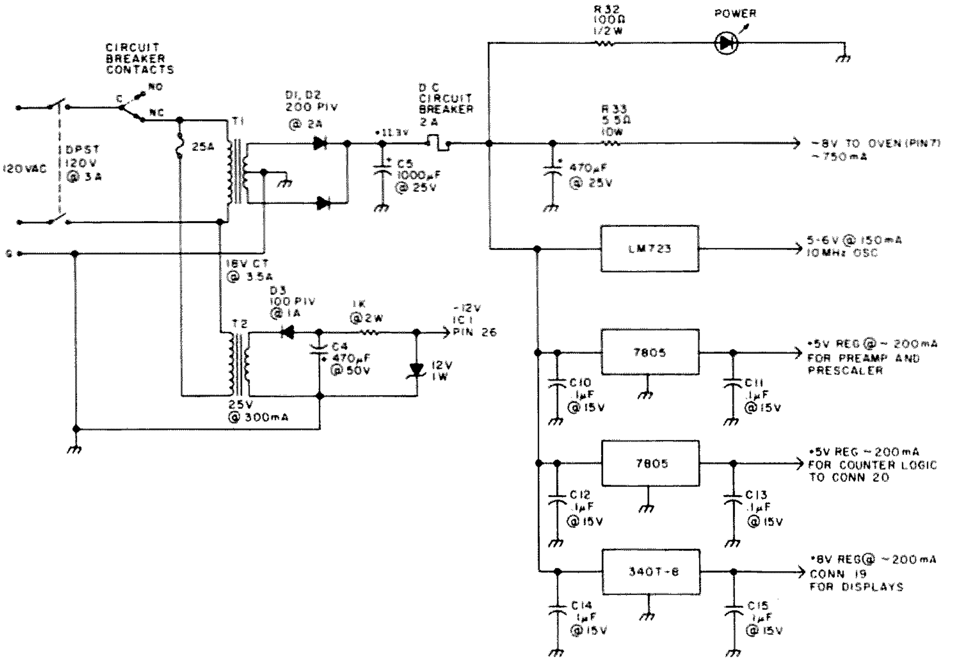


Fig. 21. Power.

transistor arrangement for the negative bias. Suddenly, I noticed the counter behaving erratically, giving some strange readings. After a few minutes of probing around, I was horrified to discover that the pass transistor had shorted and the −12-V nominal bias had soared to −32 volts! This, with the +5-volt positive supply, meant that the 7030 was enduring 37 volts! I was certain the 7030 had counted its last, but it survived, and so did I! In the interest of simplicity, I fell back to the present bias arrangement shown in Fig. 21, and there are no regrets yet.

Besides the ordinary fused primary-transformer-winding protection, I used a 2-Amp dc circuit breaker in series with the 12-volt positive supply. If this CB should trip, the ac line voltage will then drop out through the CB's external switch contacts. A dc circuit breaker is certainly not a necessity, but they can be had in most surplus houses for a dollar or so. I also used a DPDT power switch to completely disconnect the ac from any part of the counter when power is off. Because there are no CMOS inputs normally left floating, potential static damage is not a concern, either.

The power pilot LED is another of those weird yellow jobs that has its attendant 100-Ohm series resistor. It provides a good bright light when connected to the unregulated 12 V dc, as well it should!

All the 3-terminal regulators have 0.1 uF disc caps across the inputs and outputs for noise suppression and for better transient response (so I'm told). As the oven turns on, the raw dc drops to about 10.8 V, still plenty to properly power the various regulators. The main transformer for the positive supply used was one purchased from my friendly neighborhood Radio Shack, the RS273-1514, rated 18 V CT at 3.5 Amps. This is more than adequate, and a similar 2-Amp transformer would be sufficient.

Construction Techniques

Most of this counter is wire-wrapped. Everything but the master oscillator, the power supply, and the two preamps are crammed on a Vector 3662 wire-wrapping board, with the matching 44-pin edge connector mounted on a homemade 1/8-inch aluminum L bracket. There is nothing sacred about using an edge-connected board. A cheaper perfboard would be adequate, but the plug-in board is handy for troubleshooting and easy modification.

The seven-segment displays also are pluggable.

22. 1-MHz 12-pin 74LS90 (master oscillator)
21. Ground
20. +5 V
29. +8 V
18. Prescaled inputs (Lo-Z)
17. Direct input (Hi-Z)
16. IC25, pin 9—segment a
15. IC25, pin 6—segment b
14. IC25, pin 2—segment c
13. IC21, pin 13—segment d
12. IC21, pin 9—segment e
11. IC21, pin 6—segment f
10. IC21, pin 2—segment g
9. IC25, pin 13—segment D.P.
8. IC34, pin 2—digit strobe 8
7. IC34, pin 1—digit strobe 7
6. IC29, pin 13—digit strobe 6
5. IC29, pin 9—digit strobe 5
4. IC29, pin 7—digit strobe 4
3. IC29, pin 6—digit strobe 3
2. IC29, pin 2—digit strobe 2
1. IC29, pin 1—digit strobe 1

Z. Lamp test NO H4, pin 3
Y. Gate LED H4, pin 4
X. Load NO contact
W. Load NC contact
V. Reset NO contact
U. Reset NC contact
T. Freq. LED H5, pin 1
S. Period LED H5, pin 2
R. Events LED H5, pin 3
P. Mode NO contact
N. Mode NC contact
M. kHz LED H5, pin 6
L. MHz LED H5, pin 7
K. Pre-MHz LED H5, pin 8
J. Input display NC
H. Input display NO
F. 0.1-sec LED H6, pin 4
E. 1-sec LED H6, pin 5
D. 10-sec LED H6, pin 6
C. .01-sec LED H6, pin 3
B. Timebase NO contact
A. Timebase NC contact

All LED connections are to cathodes. Anodes are tied to +8 V on front panel. All switch commons are grounded on front panel.

Fig. 22(a). Logic-card edge-connector pin designation.

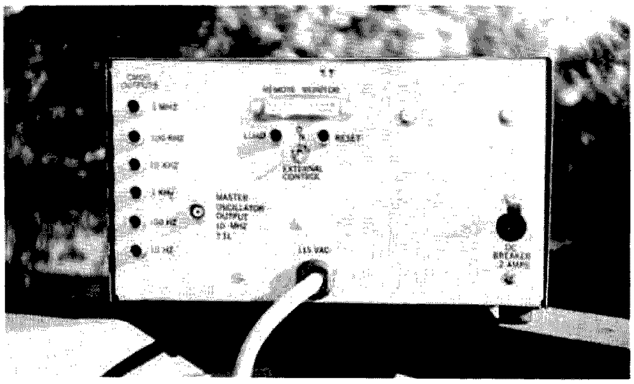


Photo B. The Universal Counter's back panel provides outputs from different points on the timing chain and allows the use of a remote monitor.

Some DIP wire-wrapped sockets were cannibalized, the pieces were spaced on a narrow 6" piece of .1" perfboard, and the eight FND 500s were mounted. The segment pins then were wrapped daisy-chain style in parallel; these seven wires, plus the decimal-point wire and the eight common-cathode wires, form one wiring harness to the 44-pin edge connector. The other harness is composed of the cathodes of the eleven front-panel LEDs (crystal-oven and power-indicator wires are brought out separately) and eleven wires from the six push-button switches (5 SPDT and the SPST lamp-test switch). Other edge connector connections include +8 volts, +5 volts, the 1-MHz signal from the master oscillator board, and the two front-end signals. A ground completes the 44 pins—see Fig. 22(a). The −12-V bias is jumpered directly to pin 26 of the 7030 on the pin side of the board.

Five 16-pin DIP headers (Radio Shack 276-1980) are used to hold the 10k pull-up resistors, the LED current limiting resistors, and the two RC networks—see Fig. 22(b). Once again this is convenient, as these component carriers plug right into 16-pin wire-wrap sockets.

I decided to tap the available source of pulses always present in the oscillator divider chain for an external set of test signals, as shown in Fig. 22(c). Six frequencies, 1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 Hz, and 10 Hz, were buffered with a 4049 hex inverter. A 16-conductor ribbon cable with a DIP socket takes the six signals to some RCA phono jacks mounted on the right rear chassis next to the master oscillator and crystal oven. These output connectors are quite suitable, as CMOS square-wave signals do not generate as many harmonics as do similar-frequency TTL signals, because of the slower rise times. The 10-MHz TTL master oscillator test signal does use a BNC output connector, however. All seven test outputs are dc-coupled by choice.

An EIA RS232C-type 25-pin connector is also on the back, labeled "Remote Monitor." Using the BCD (Binary Coded Decimal) outputs of the 7030 with each digit clocked out by its strobe, the information in the counter is made available to any desired external device that is plugged in. Movable jumpers soldered to the RS232 connector can sample this display information as well as enable the remote control of counter operations. An obvious candidate for such connection would be a microprocessor. If such mating is desired, it would be wise to recall that the sampling rate is equal to the multiplexed-display scan rate (1 kHz for this machine).

A DPDT switch, also on the back panel, selects whether or not the display-start-stop and count-reset 4013, IC37, flip-flop is controlled from the front push-buttons or from another external source via two more RCA phono jacks.

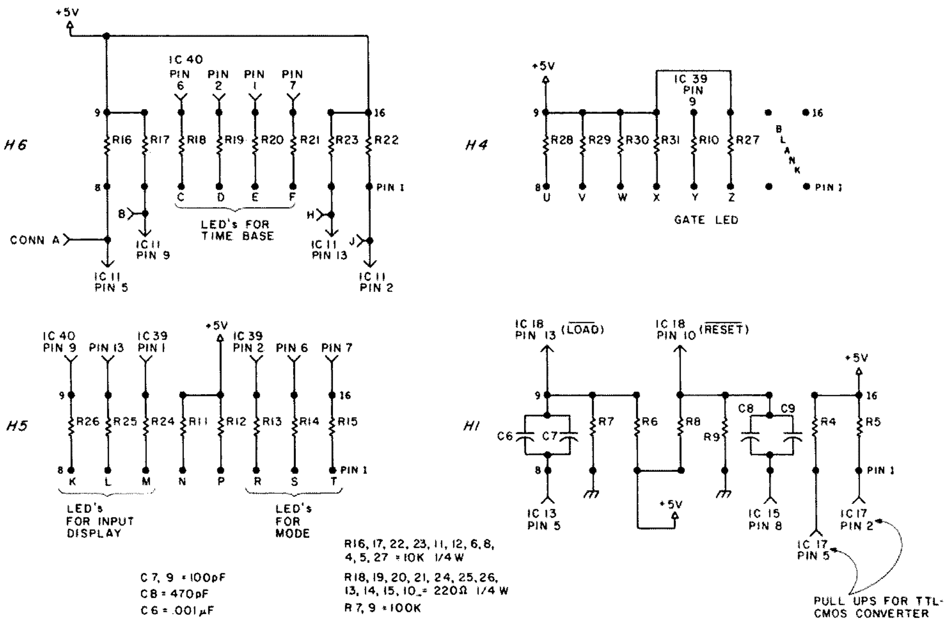


Fig. 22(b). DIP component carriers.

The push-button switches are surplus computer types, bought for $1 each. They are large and bulky, but they "click" nicely. You could use whatever momentary SPDT switches are suitable and/or available.

Radio Shack was the source of the cabinet. Two reinforcing rods made from scrap phenolic are used to stabilize the chassis which becomes a little unsteady after all the components are mounted. It is quite sturdy, though, when the vinyl-clad steel cover is in place.

The jumbo LEDs are mounted in "Clip-lite" holders in ¼-inch holes. These sharp-looking mounting devices are worth every penny. You'll not be sorry if you spend for them. Quest Electronics (PO Box 4430C,

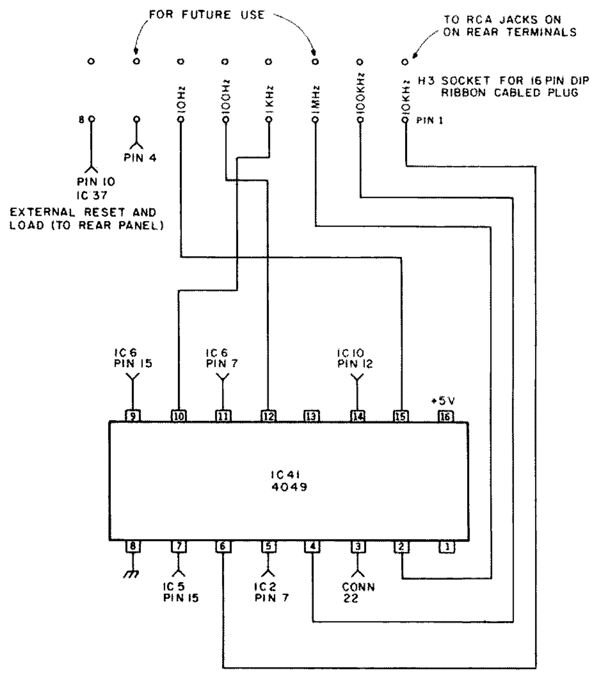
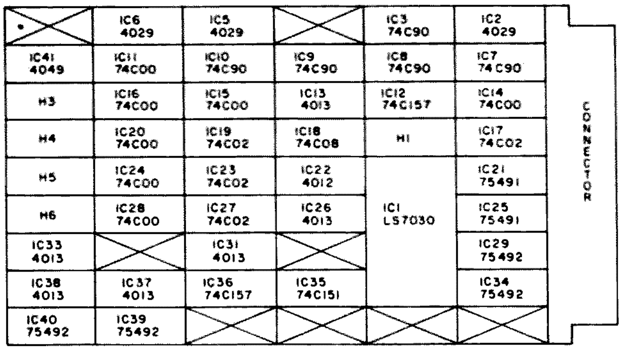


Fig. 22(c). CMOS test-signal output buffer.



ICs on main counter board:

IC1	LS7030	IC21, 25	75491
IC2, 5, 6	4029	IC22	4012
IC3, 7, 8, 9, 10	74C90	IC29, 34, 39, 40	75492
		IC35	74C151
IC11, 14, 15, 16, 20, 24, 28	74C00	IC41	4049
IC12, 36	74C157	Preamps: 11C90, 74196, 74LS04	
IC13, 26, 31, 37,38	4013	Master oscillator: 5400, 74LS90, LM723	
IC17, 19, 23, 27	74C02	Power supply: LM340T-8 and two 7805s	
IC18	74C08		

Fig. 23. IC socket-location chart.

Santa Clara CA 95054) has them, as do a few others. Dry transfer lettering identifies the lights and switches.

Here are a few helpful hints on the wire-wrap board. The 3662 Vectorbord® is 4.5 × 6 inches. The IC sockets, forty in all, densely populate the board. No effort was spared to carefully document and methodically wrap the circuits one section at a time. Four different colors of wirewrap were used: one for power, one for ground, one for all intra-board connections, and the last for board exits to the edge connector. Vector T-44 pins were soldered to the board's edge-connector pads to provide wrap points.

A necessary preliminary step is to make both a pin-side and a socket-view board map showing all socket and IC locations so you'll know which socket you are wiring (see Fig. 23). All power and grounds should be wrapped next. An ohmmeter will quickly spot shorts and opens. The TBOD chain was then wrapped, and the ICs were inserted and then powered up. After proper operation was observed (following a few corrections), the ICs were carefully removed and set aside in conductive foam. Each section was wired and debugged individually before the various control lines were sent to the far reaches of the board. The usual sequence was wire-wrap, IC insertion, smoke test, then debugging for the surviving ICs. The construction sequence I used was switching, display, decimal point, and, of course, the counter circuitry itself.

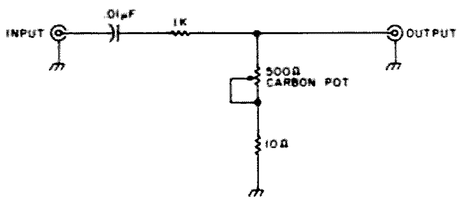


Fig. 24. External Lo-Z attenuator.

This sort of experience points out the extreme flexibility of wire wrapping. In this case, a fairly serious revision costs only some thought and a few wires. A printed-circuit approach would have resulted in at least the abortion of the first board layout, and probably abandonment of the project due to frustration. The other point is that I had breadboarded only a basic frequency-only counter to coarsely check out the basic counter circuits. The abandoned decimal-point circuit was initially conceived solely from a personal interpretation of the 7030 data sheet. Only reality and the actual circuit operations, or lack thereof, provided the necessary guides and corrections to my thinking. The value of breadboarding your first-order attempts can't be overestimated. The old adage, "If it works on a breadboard, it will work anywhere," has been proven many times.

Successful wire-wrapping of larger projects takes some persistence and defenses against paranoia. Persistence to follow through, and resistance to the slightly paranoid feeling that every little 30-AWG wire you miswrap could be the one that causes nights of insomnia and a new vocabulary for those around you.

This is the place where the documentation and organization of your project pay off in steady progression until successful completion, and in the building of confidence in yourself and in your design work. Remembering this can mean that your projects will perform reliably, as you intended, and that they can be fixed when necessary without resorting to a human sacrifice (you!) to appease that ever-lurking god of home-brew, *Nevor Wark!*

The rest of the pieces are best obtained from some of the great variety of small parts sources widely advertised. It is possible to save 30% or more on ICs and sockets, displays, etc., by comparison shopping.

If you are purchasing most of your components new, consider using all 74C90s for the divider chain, as mentioned earlier, since they are cheaper than 4029s and also less expensive to socket.

The counter has no internal attenuator because a useful one would not fit inside the cabinet. The Hi-Z input needs only loose coupling with proper shielding anyway to pick up virtually any signal, because of its sensitivity. The Lo-Z is about 30 Ohms or so at higher operating frequencies and doesn't mind being driven from a 50-Ohm source.

Conclusion

The WA2FPT 7030 Universal Counter is an evolution of this ham's ideas and dreams. Taken by themselves, the various portions of its anatomy are not particularly new or daring. The useful combination of these common design techniques, though, has resulted in a counter that is a joy to use and has flexibility not found in counters at $500 or more.

Don't build this counter if all you want is that bare-bones $100 frequency counter or one of its brothers. Do create one, however, if you want the adventure of incorporating wire-wrapping, top-notch front ends, a voltage-tuned master oscillator, and all the other goodies. Then scrape together the $100-$150 you'll need and jump in. The little touches like the push-button function selection and LED indicators only serve to set this counter apart from all others. It's a small price to pay for a little distinction and some personal fulfillment. You, too, can build yourself as you build your counter. I'd be interested to learn how yours turns out.

It's been great "wrapping" with you! ■

Double Trouble on 50 MHz

—Home-Brew Contest runner-up

Ed. Note: KL7GLK's article was the runner-up in our Home-Brew Contest. Larry will be receiving a $100 bonus in addition to his normal article payment.

Larry Jack KL7GLK
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"That's *milli*watts," I explained to the Florida station. It's okay, I thought; three of his neighbors had missed the milli part the first time, too, or maybe they just didn't believe it. The truth was that I was just as surprised as I talked to one six-meter station after another on less than one quarter of a Watt. True, the band was hopping with summer E skip, but that didn't diminish my thrill of working QRP DX.

I was using a little double sideband transmitter I'd originally designed for the license-free 49-MHz band. For you fellow Forty-Niners, it works quite well there (reduce the input to 100 mW). It has been heard over 25 miles. When six opens up and the ham in you returns, changing the crystal to 50 MHz is when the fun really begins.

Circuit

The transmitter centers around an active balanced modulator fed by a crystal oscillator. Two stages of linear amplification result in a signal of 250-400 mW with a carrier suppression on the order of 40 dB. I have had mixed results with passive diode ring modulators at 50 MHz. Carrier suppression is tricky. This active design, however, tunes cleanly right from the start and should present no tune-up difficulties.

The oscillator is a particular gem. The credit goes to K1CLL (May, 1970, *73*) for such a trouble-free design. L1 is 15 turns of #30 enamel wire close wound on a 3/8-inch-diameter slug-tuned form. The crystal tap is 5 turns from the collector end of Q1. The oscillator feeds the emitters of the balanced modulator through a resistor network. R1, a 2.5k trimpot, is used to null the carrier. L2 is also a 3/8-inch-diameter slug-tuned coil, but it is center-tapped, 24 turns of #26 enamel wire. L3 is six turns of insulated hookup wire wound over the center portion of L2.

The audio stage that drives the modulator is a salvaged amplifier out of a defunct tape recorder. Any 1-Watt amplifier will work fine. There are so many inexpensive sources of these amplifiers that it does not pay to spend the time building one yourself. T1 is the normal output transformer that once fed a 16-Ohm speaker. If all that is available is an 8-Ohm output transformer, it will work, but it will not give as much drive. A speech clipper using a pair of 1N695 diodes

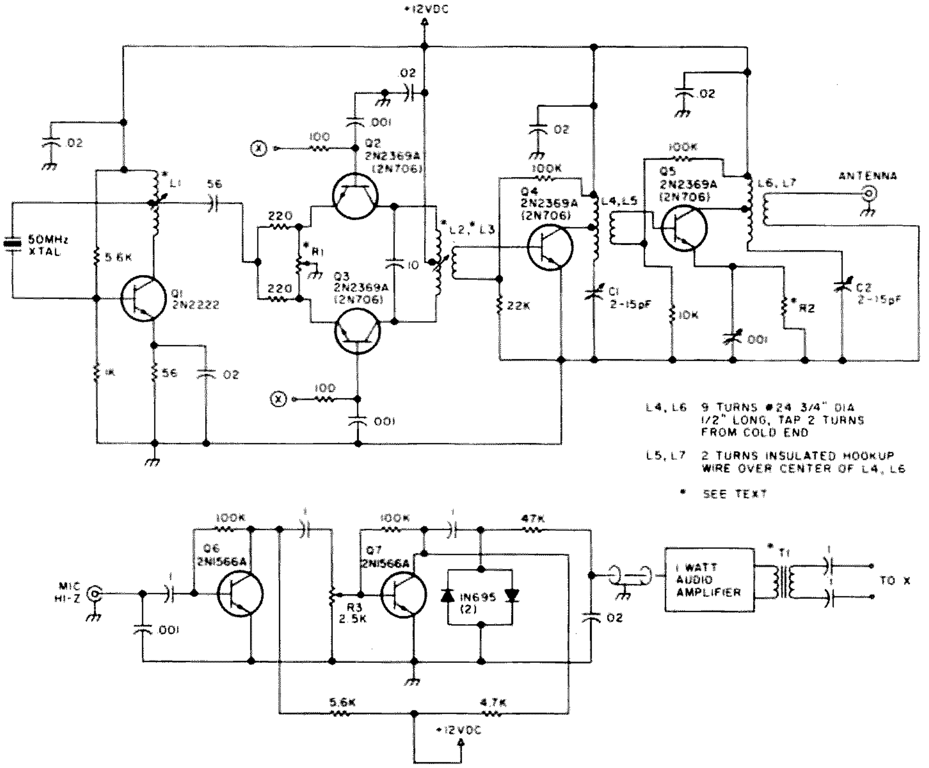


Fig. 1. 50-MHz DSB transmitter.

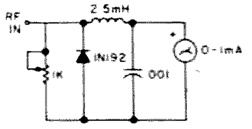


Fig. 2. Field-strength meter.

limits the audio frequency response. This feeds into the input of the audio amplifier. Q4 and 5 are biased as linear amplifiers; depending on the value of R2, the input can vary from a few milliwatts up to 400.

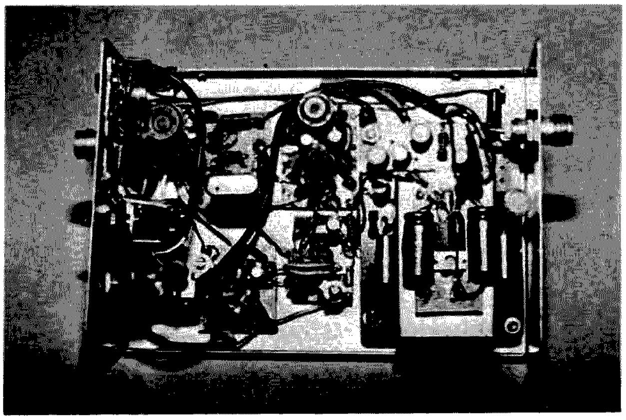
Tune-Up

I have found using a field-strength meter (FSM), Fig. 2, the easiest way to tune up this transmitter. Power is applied to both the oscillator and the balanced modulator, but disconnect the audio stages. Clip the FSM to one side of the emitters of Q2 or 3 and adjust L1 to maximum. Remove the meter and attach it to the base of Q4. Adjust L2 for maximum, then R1 for a minimum reading. It should be possible to achieve a deep null by alternating the tuning of R1 and L2. This will adjust the level of carrier suppression. Remove the FSM and apply power also to the audio stages. With a 50-Ohm ½-Watt resistor as a dummy load and the FSM attached to the output at L7, apply a tone (i.e., whistle into the microphone) and adjust C1 and C2 for maximum.

You're ready to go on the air.

Life On DSB

If you've never operated DSB before, be prepared for some strange signal reports. Most stations will not be able to tell a difference between DSB and the other SSB signals on the band. A few will be confused by that extra sideband . . . Ah, but that only makes things all the more exciting. Wait until the other guy also finds out it's only a quarter Watt of power. You'll have no end of interesting QSOs after that. ■



Six-meter DSB transmitter in a minibox.

Parts List

Transistors

Q1 2N2222 HEP equivalent HEP55
Q2-5 2N2369A (2N706) HEP equivalent HEP50
Transistors came from a "grab-bag" from Poly Paks, Inc., Lynnfield MA. Priced individually from a parts house as HEP equivalents, approx. $1 each.

Crystal

50-MHz 3rd overtone in HC6/U holder
Available from Jan Crystals, PO Box 06017, Fort Myers FL 33906.

Capacitors

C1,2 Johnson air variables 1.7-14.9, miniatures, type T-6-5
Available from Semiconductors Surplus, 2822 North 32 St., Phoenix AZ 85008.
10 pF silver mica
56 pF silver mica
From the same source above.
6 .02 uF ceramic capacitors
General capacitor assortments from Poly Paks or Radio Shack; values from .005 to .01 work fine.
4 .001-uF ceramic capacitors
Same sources as above; values .001-.005 uF work fine.
5 .1-uF ceramic capacitors
Same sources as above; values .01-.1 are suitable.

Resistors

1 56 Ohms
2 100
2 220
1 1k
1 4.7k
2 5.6k
1 10k
1 22k
1 47k
4 100k
All these are 1/8-Watt 10% carbon resistors. From grab-bag assortments from Poly Paks. Available also from Radio Shack.

R1, 3 2.5k miniature trimpots
A-B type F number FR252U is the type used, although any small 2.5k variable resistor will work fine.

Diodes

1N695 SK3087, 1N914, 1N456, HEP 158 will also be suitable; from a grab-bag of diodes, silicon types.

Coils

L1,2,3 Salvaged iron slug-tuned coil; for number of turns, see text. Ramsey Electronics or Digital Research: Parts, PO 401247B, Garland TX 75040. Variable inductors for forms.
L4-7 Free-handed wound coils of #24 copper wire. See text.

Audio Amplifier

1-Watt audio amplifier with a 16-Ohm output transformer. Salvaged from a Radio Shack tape recorder. Any Hi-Z input audio amplifier with an 8-16-Ohm (see text) output transformer of approx. 1-Watt output is suitable (i.e., from a clock radio, portable AM/FM radios—hamfest materials).

Miscellaneous

Cabinet Small 5 × 7 × 3 inch metal box from Radio Shack.
BNC coax connectors
Microphone jack from Radio Shack
DPDT switch (for T/R)
Pilot lamp
PC board
Q6,7 2N 1566A RCA SK equivalent SK 3009

RF tuning meter

M1 Any milli- or microamp meter movement; can also be a multimeter attached to the diode-choke network.
RFC 2.5 mH Any surplus choke in this range; also jumble winding about 200 turns of #30 wire on a high value 2-Watt resistor will work. 2.5 mH choke from Radio Shack.
1N192 Can be any silicon diode. See above sources.

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The $100 TVRO Receiver

—Satellite Central, part IX

Ed. Note: Part I of *73*'s "Cheap Trick" $100 satellite TV receiver series appeared in the August, 1982, issue.

Building your first TVRO receiver can be fun if you start with a well-thought-out design such as this dual-conversion model by Dwight (Rex) Rexroad. Despite Cheap Trick's cost, you'll be surprised at the results. The proof is in the picture!

Last month, we covered the simple downconverter box which used cheap components to get the 3.7-to-4.2-GHZ TV satellite signals down to 500 to 1000 MHz i-f. See the diagram in Fig. 1(a). According to Rex, "The conversion gain of the tuner is about 10 dB. The levels into the i-f amp are not unlike those found in other receivers made today."

Photo A. Dwight Rexroad with his $100 receiver.

Clever Construction Technique

Building a home-brew VHF device such as this has its own set of problems. Because this will probably be a one-of-a-kind unit, it doesn't make a lot of sense to sit still long enough to engineer a PC board layout. Likewise, the Vectorbord® point-to-point wiring technique can eat time like a parking meter. So Rex applies a secret used by many VHF experimenters. The entire baseband unit is built on copper-clad perfboard, which is ideal because you put the clad portion on the top and do the wiring on the bottom (see Photo B). Says Rex, "I've got this humongous ground plane there. Anywhere I want to ground, I just stick a wire in a hole and solder." A hole that must allow a wire to pass through is cleared of excess copper with a ¼-inch drill bit operated by hand. This trick not only saves time, but keeps even the most cantankerous VHF circuit from running off on its own. As Rex says, "This is not a critical receiver. You've just got to apply good layout, grounding, and short leads."

Bandpass Filter

Rather than use adjustable coils in his filter (see Fig. 2), Rex chose to use fixed coils and adjustable

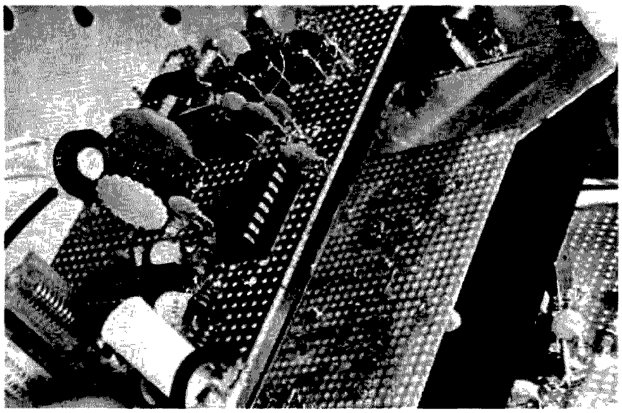

Photo B. Believe it or not, everything is socketed. No problem at 70 MHz as long as you have a large groundplane nearby. The mirror in the photo shows the wiring below the groundplane.

capacitors to save money. For a further saving, Rex suggests you buy the coil assortment sold by Radio Shack and rewind your own. Or you can use the Amidon T-50-6 cores.

Rex comments, "Design-wise, the filter is similar to that by Taylor Howard. Alignment is best done with a sweep generator, because you'll go crazy using anything else. The ideal curve would be flat as a pancake from 55 MHz to 85 MHz. Try to keep it especially flat from 60 to 80 MHz for best results. I'd like to make a nonadjustable filter work. Maybe I'll figure one out with Cheap Trick II."

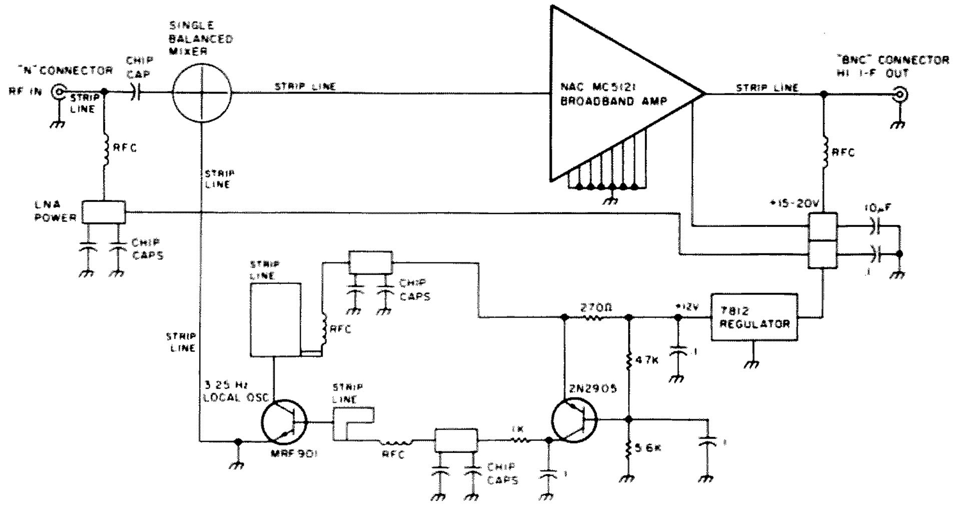

Fig. 1(a). A fixed-frequency local oscillator drives a balanced mixer in the first conversion stage of the Cheap Trick receiver. The MC5121 amplifier drives a modified UHF TV tuner where the signal is downconverted again. This circuitry was described in last month's edition of Satellite Central.

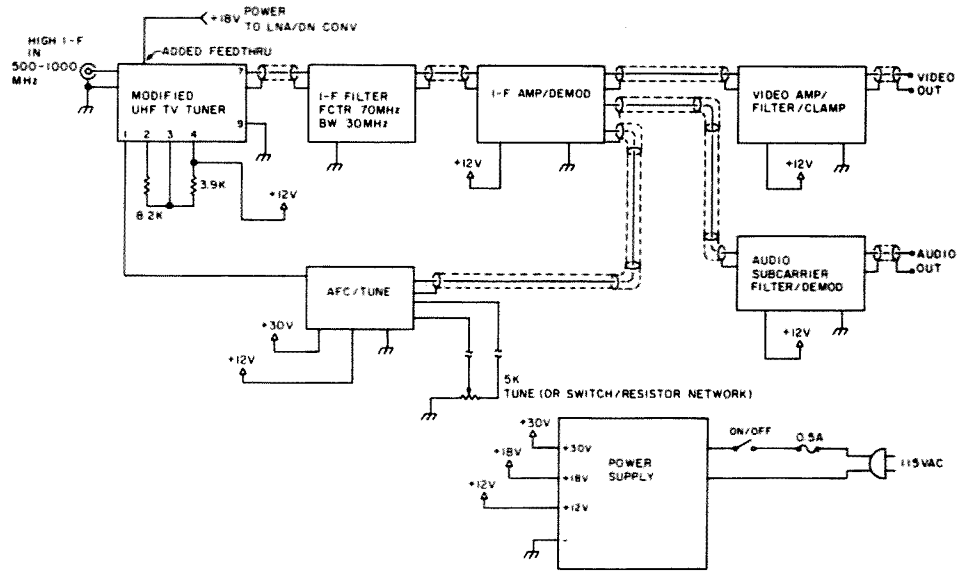

Fig. 1(b). The baseband circuits consist of off-the-shelf ICs.

Get Out of the Mud

Moving on to the 70-MHz i-f amplifier in Fig. 3, we find that Rex did what every TVRO designer should have done in the begining—He used off-the-shelf parts. Here's a perfect example: He used the readily available MC1350. This is the workhorse i-f amplifier used in many TV sets and bootleg subscription-TV decoders built today. With a cost of only $1.38 and easy availability, it's a natural. The input impedance of an MC1350 is more than 1k, so Rex put a 75-Ohm resistor on the input to properly terminate the i-f filter.

"At 70 MHz, the MC1350 has about 20-dB gain in the broadband mode. Of course, they run much better at 45 MHz where you find them in your TV. The MC1350 has both differential inputs and and outputs. One differential input is bypassed to ground. Pin 5 is the i-f gain-control input. Like everything else in this circuit, it is bypassed." Later on, you can feed your agc into this pin. If you were to try your hand at using a 564 PLL detector, you might have to put the control on the front panel since the 564 is level sensitive. On the other hand, using the nifty MC1357 quadrature detector can make the i-f gain a simple "set and forget" operation.

Rex suggests using peaking coils on the differential output because he found an expected gain slope. "It starts around 20 MHz and goes downhill pretty fast. I have a sweep of it running from 10 to 100 MHz. It's a nice diagonal line!" Putting .18-uH coils on the 220-Ohm load resistors will peak the MC1350 on 70 MHz. The 500-pF coupling capacitors are not critical.

The other parts values in the circuit are right out of the Motorola handbook. "I use Amidon slip-on ferrite beads. A bagful of beads is a lot cheaper than a batch of chokes. You don't need large inductance values here, not at 70 MHz. A bag of beads is only a buck, and one sack will do."

The second stage, like the first, uses typical book values. The gain resistor on pin 5 is the current-limiting resistor value for a maximum gain. It's just that simple. Interestingly enough, Rex found that grounding pin 5 on the MC1350 did not produce maximum gain. Instead, it produced less. But start to add some resistance at pin 5 and the gain will rise to maximum at about 5.2k Ohms. The output feeds a broadband transformer wound on still another ferrite bead.

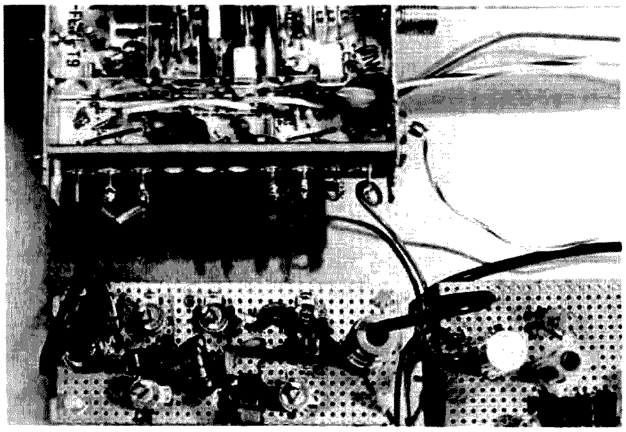

Photo C. You can get away with RCA jacks on the 70-MHz filter, seen below the UHF tuner.

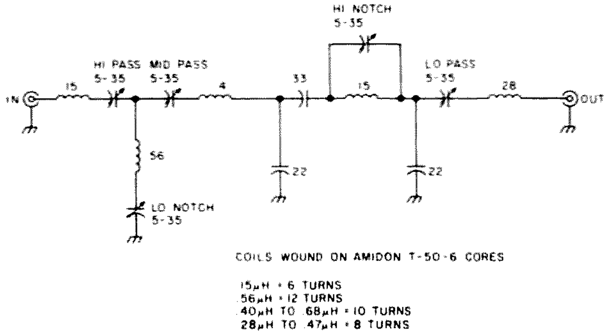

Fig. 2. Diagram of the 70-MHz filter. The circuit uses adjustable capacitors for tuning.

The diodes on the secondary afford an excellent spot to attach a 1-mA carrier meter for antenna aiming, tune-up, an S-meter, or even agc. Here's a typical place where Rex applied excellent engineering technique. Previous designs had used a small capacitor and a series resistor to feed the diodes. A few moments of thought brought Rex to the conclusion that what is really needed is just a single capacitor with about the same series reactance as the resistor. This will allow you to eliminate the resistor (one less part) and get exactly the same results! "I can't help it," says Rex, smiling. "This project must be truly cheap."

Divide the Headache in Half

Back now to the rf transformer. The secondary feeds one half of a 74S112, a divide-by-two circuit which shifts the 70-MHz signal down to 35 MHz where the detector can deal with it better. The 500-Ohm pot was chosen as a good value to make adjustment easy. "Despite the doubters, it works like a charm. The adjustment is not critical. All the pot does is set the bias for the trigger input. Just find a weak signal, and tweak for minimum sparklies. The symmetrical gain limiting in the previous stages (not found in all satellite i-f amplifiers) makes this adjustment very easy."

Perhaps you've noticed that the 74S112 is running from a 12-volt supply. Impossible? Probably. Instead, the voltage-divider combination of the 500-Ohm pot and the 180-Ohm dropping resistor set the Vcc for the chip to about 5 volts. Those of you who handle workhorse ICs such as this know that you can fiddle with the voltage nearly a volt either way and not see any big problems. This technique saves the cost of a zener diode. And the brand of IC doesn't matter. It costs less than a buck. Just be sure to use a 74S112 rather than a 74LS112 which may only make it to 50 MHz.

Some Receivers Look Bad, But Not This One

Gain margin in this system is about 20 dB. If the input level to the divide-by-two circuit changes radically, you will need to readjust the pot. "That's what happens with so many of the typical divide-by-two designs used in receivers today," comments Rex. "If you transport them from one dish/LNA setup to another, you may need to reset the threshold. Still, it's not as critical as a design that uses the 564 PLL.

"The signal level on the output of the 74S112 should be peak-to-peak just under 5 volts. A flip-flop

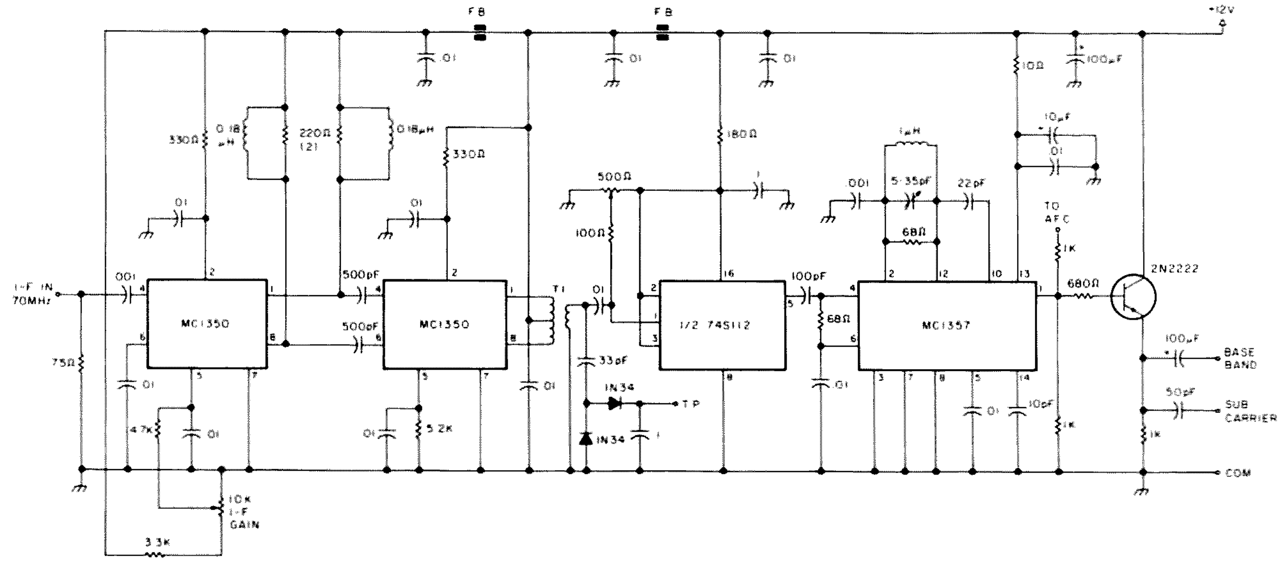

Fig. 3. Bargain-basement ICs highlight this baseband design. The MC1357 quadrature detector produces a better picture than most PLL detectors. T1: pri.—4 trifilar turns; sec.—2 trifilar turns; #28 wire, Amidon 101-43 bead.

running at high speeds usually does that," comments Rex. "Funny thing is, the MC1357 detector that follows has about 40 dB more gain, so we've got to swamp it down on the input with a 68-Ohm resistor. It really doesn't seem to matter much value-wise.

"The input to the MC1357 is differential so we bypass one and use the other. The only critical thing about the detector is that you must use short leads, especially to ground. Pin 5 has a bias de-emphasis capacitor with pin 14 acting as high-frequency de-emphasis. We don't get around to true video de-emphasis until later. The output stage has a tendency to oscillate at deviation extremes. You wouldn't hear it at audio, but you'd see it in video. So I've got that 10-pF cap which rolls us off at the high end just a bit, but not enough to suck out the subcarriers. Use a twisted-wire gimmick if you want." Rex believes you could even forget the cap if you don't mind knowing that your sync tips will look dirty.

Avoid Oscillation

It must be remembered at this point in the description that this is indeed a VHF device. Using little 10-pF caps won't mean a thing if your lead dress is long and sloppy. Chances are it won't work at all. If you do build the unit on perfboard, be sure to keep everything short. A sure sign that lead dress needs attention will be poor high-frequency response. Use plenty of bypasses such as on pin 13 of the MC1357 where parasitics can occur. Interestingly enough, oscillation at this point will likely come from the amp in the chip itself rather than the i-f amps. Like everything else in Cheap Trick, the cost of the MC1357 is less than that of the popular 564 PLL—about $1.50.

The quadrature coil on pins 2 and 12 is very noncritical. Rex comments, "The S curve is wider than the bandwidth we want, so all you'll get if you mistune it is an offset dc output. It could be a problem when you add the afc loop. Another symptom is that the picture will be a little bit washed out. But you'd have to mistune it radically for that to happen!"

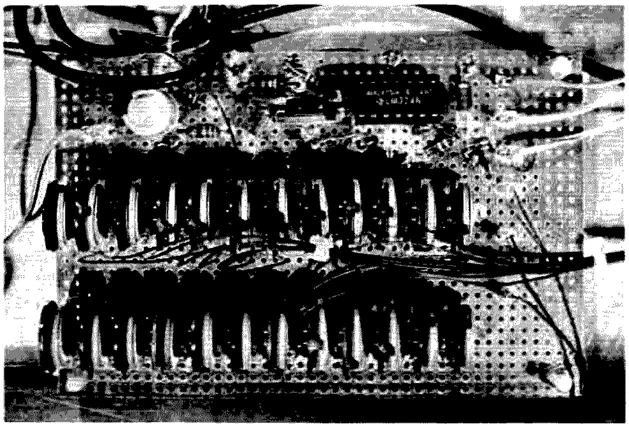

Photo D. Tune like the pros with a rotary switch thanks to a stable design and afc loop. Buy the pots at a swap meet to keep the total receiver cost from inching past $100.

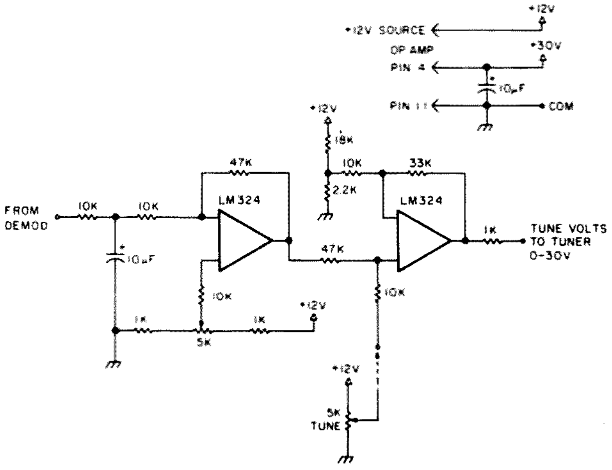

Fig. 4. This simple afc loop circuit samples the detected video offset to control the UHF tuner local oscillator.

The tune/afc circuit in Fig. 4 is simply a feedback loop. Rex filters the video with an RC network. He used an LM324 wired to the single-ended 30-volt supply. A 5k pot on the non-inverting input not only sets the output to zero volts, but compensates for the discovery that the MC1357 detector doesn't always yield an output at exactly half the supply.

The second amp mixes the 5k tuning control with the afc feed to control the UHF tuner. The resistive divider on the inverting input allows the amplifier to develop a zero voltage output which is necessary for the UHF tuner range. The LM324 is one of the few amps that can work at these voltages. And you still have 2 unused amps in the chip which can be for optional metering or agc circuits.

If you find a deal on small 5k pots somewhere, Rex suggests you mount a batch of them on a board as seen in Photo D and feed a rotary switch to get decent tuning. This method works very well thanks to the good stability of the design and positive action of the afc circuit.

Video Magic

The detector output is fed into an emitter follower (a 2N2222 costs 10 cents) where the baseband video feeds a 100-uF capacitor. The sound subcarrier signals are fed from the same point through an RC high-pass filter to the detectors. Moving on to the video circuit in Fig. 5, the 75-Ohm video de-emphasis circuit that follows is unique because it uses fewer parts and does essentially the same thing as commercial designs. More importantly, Rex says, "it uses parts that are closer to standard values than other designs. You can buy all the parts over the counter."

The pi network that follows acts as a low pass to yank out the sound subcarriers and noise. The 75-Ohm resistor that follows acts as a proper termination to ensure that the standard values you use will get the same response. The signal is dc-coupled into a 733 video amplifier which also has a differential input. Because Rex used a single-ended supply, he used a voltage-divider network to feed the inputs. The 10-uF capacitor in the divider is necessary because the signal has a lot of low-frequency components. The 10k pot acts as a gain control and should give you enough control for even half transponder video levels. "The 733's minimum gain is higher than the 592. That's the only difference I can tell," says Rex. "They both cost about a buck. Performance-wise, it's a toss-up. I use the flat-pack versions. You could skip the video polarity switch since a jumper will do."

Getting a Perfect Picture

The clamp circuit re-

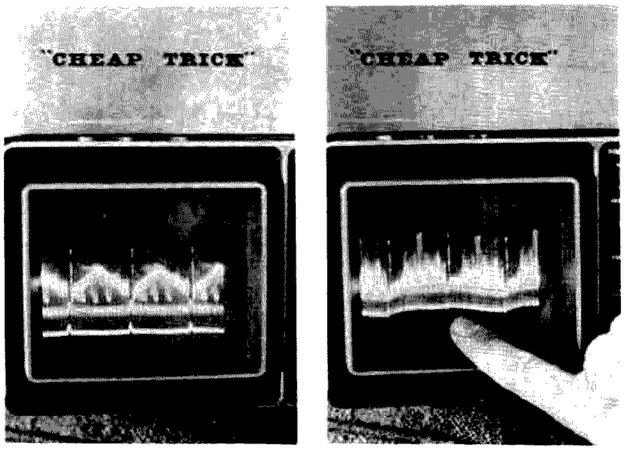

Photo E. Tweaking the clamp-circuit coupling capacitor will reduce picture flicker, but it may also affect the video baseline (seen at right).

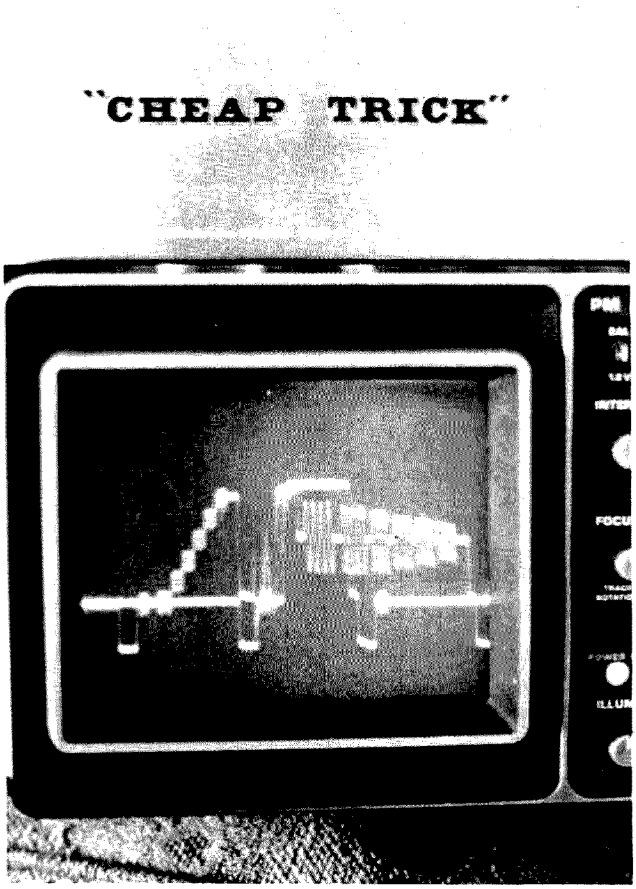

Photo F. The proof is in the pudding. This multiburst display from Satcom 3 shows that the receiver high-frequency response is none too shabby.

moves the frequency-dispersion waveform from the signal. This is a common design used in many receivers today and is described by Lancaster in the *Cheap Video Cookbook*. "It doesn't work perfectly. You can make some trade-offs. If you are getting too much flicker in the picture, you can lower the value of the 1-uF cap feeding the diodes." Rex goes on to say that, "too much reduction in that value will produce a large amount of tilt in the vertical interval." This means the idea is fine unless you want to chase data hidden in the vertical interval later on (see Photo E). Most TV sets don't see the tilt, but a high-speed data comparator will. The last emitter follower has a low output impedance, so a terminating resistor is placed in series. It works well with cable lengths up to 50 feet without ringing. The final output high-frequency response can be verified by looking at the multiburst waveforms in the vertical interval of some transponders. You'll be amazed at the quality of this receiver as seen in Photo F.

The sound demodulator in Fig. 6 is straight out of your typical 4.5-MHz TV set sound section with a clever trick to make it work slightly better and still use cheaper parts! Rex uses input transformers that are the surplus 10.7-MHz i-f types found in cheap portable FM sets. They are retuned to 6.8 MHz, the most often used sound frequency. "A common source is Poly Paks where they cost about 28 cents apiece!" You may find that you'll need to adjust the values of the parallel 56-pF caps from 50 to nearly 120 pF to get the entire range of possible subcarrier frequencies. See Satellite Central VI and VII for more background on subcarriers.

The transformers are wired back to back on the input. The signal feeds the low-impedance winding from the 50-pF cap back into the video demodulator. The circuit then becomes a conventional bandpass with the output low-impedance winding of the second transformer feeding the input to the CA3065 FM quadrature sound demodulator. "This configuration works very nicely since they were designed that way. There are a lot of 4.5- and 10.7-MHz circuits out there using these parts," comments Rex. "The circuit is right out of the handbook. I use the same value of quadrature tuning cap (82 pF) which seems to hold over the band. I was just too cheap to use a coil in the

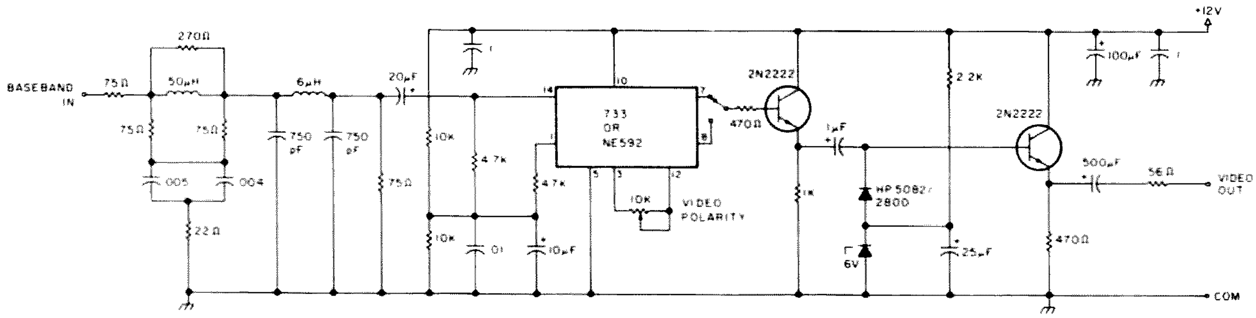

Fig. 5. Easy video processing with a standard component low-pass filter, clamp circuit, and video DA.

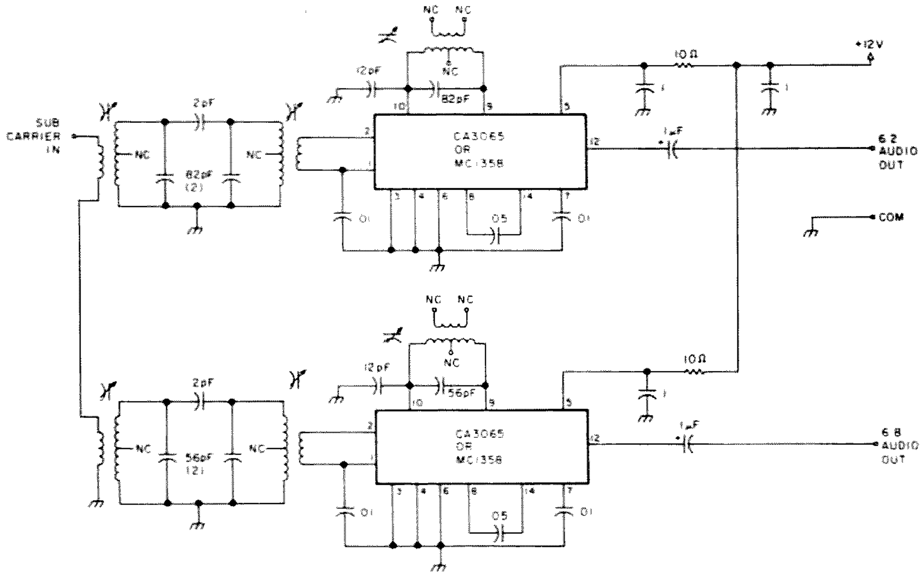

Fig. 6. The subcarrier sound detector uses a single TV sound section IC. Good sound quality results from using cheap FM i-f transformers in a bandpass network on the input.

network. So I used another 10.7-MHz transformer. It works fine."

Can You Really Do It for $100?

A Clint Eastwood movie a few years back, titled *Dirty Harry*, had a good line in it that zeros in on the approach to take with a project such as this. The cool detective character Harry Callahan gave sage advice when he said, "A man must know his limitations." It is perhaps somewhat fitting that you too should consider your own particular abilities with VHF circuitry and parts scrounging. If you've never done any VHF work or think that parts procurement is simply picking up a telephone, then you should reconsider that you can indeed duplicate this receiver for less than 100 bucks.

Now I'm not trying to say this is a tough project—only that you will need to be careful if it is one of your first. The clever tricks of Dwight Rexroad put the price within reach as long as you do the work. It's worth the effort because your learning curve will be up several notches on completion. Besides, this may be one of the best little family attention getters you could try because of the use it will get when you finish it. Just think of all that hamming you can do with everyone else pacified.

Questions? Only those accompanied by an SASE can be answered. Sorry, no calls. Have fun with this one! ■

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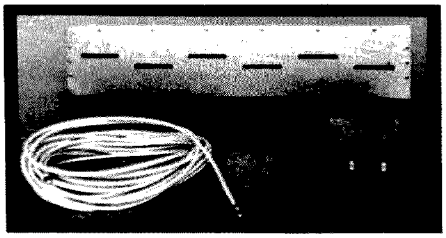

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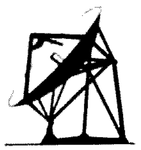

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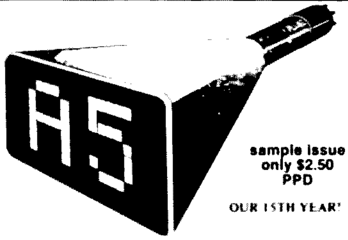

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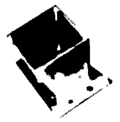

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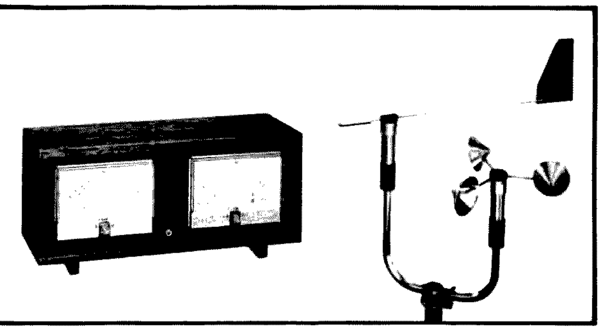

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Digital Basics

—part I

Joseph J. Carr K4IPV
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Digital electronics has hit amateur radio—and hobby electronics in general—in a big way! This field of electronic endeavor was once the province of a few freaky computerniks, military electronics technicians, and industrial electronics types, but today, *none* of us can safely ignore digital electronics.

Digital electronics is, in a way, actually simpler than conventional analog electronics because the digital logic devices recognize only two states, i.e., ON and OFF. This fact makes digital circuits similar to relays and mechanical switches. Simple, huh? In fact, some digital circuits are little more than high-frequency electronic versions of simple switches. It is my opinion that anyone who can understand simple relay and switch circuits also can understand the basics of digital electronics! Certainly anyone who can understand the vagaries of single-sideband and FM communications equipment will be able to understand digital electronics.

In this three-part series, we will explore the various forms of IC logic elements: gates, flip-flops, and multivibrators. In this first installment, I am going to give some basic definitions, introduce you to the popular IC-device families, and explore the principal forms of logic gates.

Logic States

I have mentioned that digital circuits respond only to two different input states—ON and OFF—which can be called 1 and 0 (after the two permissible digits of the *binary*, i.e., base 2, number system), HIGH and LOW, or (in older textbooks) "true" and "false." These designations are used to refer to two different voltage levels. In this article, I will stick to the HIGH/LOW designation because it will graphically describe what is actually going on in the circuit.

Transistor-transistor logic (TTL) responds to 0 and +5 volts for the two logic levels. If any other voltage levels are used, then the TTL device will either (1) fail to work, (2) work unpredictably, or (3) burn out (ZZZAPPP!).

Fig. 1 shows the TTL logic levels.

Positive and Negative Logic

You may sometimes hear the terms positive logic and negative logic. These terms sometimes tend to confuse the newcomer; they mean nothing more than how the HIGH and LOW *logic states* are related to *voltage levels*. In *positive logic*, the HIGH is logical 1 and will be a positive voltage (e.g., +5 volts in the case of TTL). The LOW, logical 0, is the 0-volts condition (e.g., in TTL). Logical 0 may be a negative voltage in some CMOS circuits. In *negative logic* these designations are reversed (i.e., HIGH = logical 0 and LOW = logical 1). In the vast majority of uses, positive logic is specified. In fact, the descriptive names given to digital IC devices reflect a bias toward positive logic. This potential confusion is why I prefer HIGH/LOW designations. The 1/0 designation

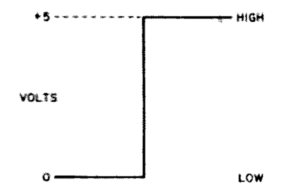

Fig. 1. TTL logic levels: 0 volts is LOW, 5 volts is HIGH.

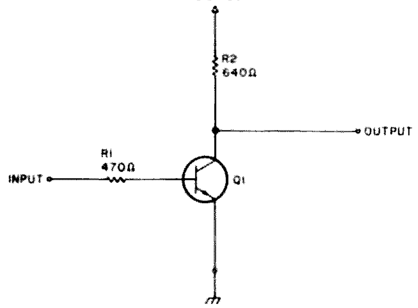

Fig. 2. This typical RTL (resistor-transistor logic) inverter circuit produces a LOW output when the input is HIGH. A LOW input is accompanied by a HIGH output. For RTL, 0 volts is LOW and 3.6 volts is HIGH.

will be reserved for the illustrations and truth tables but keep in mind that *positive logic* is used unless otherwise noted.

Logic Families

A *logic family* is a series of IC devices that may easily be interconnected and which use similar technology in their construction. All of the devices within a given family will have the same input and output circuits, so that direct interconnection is possible.

The only major consideration is whether an output can supply sufficient current to drive all of the inputs that are connected to it. But in any given logic family, output voltage and current levels and input voltage and current requirements are fixed by agreement. They are defined in terms of units of *fan-in* and *fan-out*. This unit is the current requirement of a single standard input at the fixed voltage level. Such an input has a fan-in of *one unit*. If an IC is said to have a fan-out of, say, five, it will *drive five standard inputs*. The device, therefore, can supply sufficient current to drive all five inputs satisfactorily. The total fan-in of all devices connected to any output must be equal to, or less than, the rated fan-out of the output.

The logic families which we will consider are: RTL, DTL, TTL, HTL, ECL, and CMOS. Of these families, CMOS and TTL are the most popular today; RTL and DTL are obsolete and no longer used in new designs. Plenty of older equipment still in use, however, contains RTL and DTL devices.

Speed vs. Power

The principal factors governing the speed (i.e., maximum operating frequency) of a digital IC are the internal resistances and capacitances. If resistances are increased so that power consumption drops, then the RC time constant of the device is longer. Long RC time constants mean slower operating speeds. As a general rule, higher-speed logic families require greater power consumption. CMOS devices, which require very little current (hence are low power), operate well only to 4 or 5 megahertz (MHz), with some devices tooting along to 10 MHz. TTL devices, on the other hand, usually work to 18 or 20 MHz, with some devices operating to well over 80 MHz.

RTL Devices

Resistor-transistor logic (RTL) is an obsolete logic family that was popular in the early to mid-60s. Fig. 2 shows a typical RTL inverter circuit, i.e., a circuit that produces a LOW output when the input is HIGH and a HIGH output when the input is LOW.

RTL logic IC devices used 0 volts for logical 0 and +3.6 volts for logical 1. If the input of the RTL inverter is grounded (i.e., placed LOW), then the output voltage will be HIGH, which in this case means +3.6 volts. But, if the input voltage is +3.6 volts, then the output will be 0 volts.

RTL devices usually carry type numbers in the uL900 range (mostly 8- and 10-pin metal cans) and MC700 series (mostly 14-pin DIPs).

DTL Devices

The next popular IC logic family was the diode-transistor logic (DTL) family. These devices operated at speeds greater than most RTL devices. Fig. 3 shows a typical DTL inverter.

When the DTL input is HIGH, diode D1 is reverse-biased. In that condition, R1 will forward-bias transistor Q1, which in turn forward-biases D2 and Q2. Voltage levels in most digital circuits are selected to *saturate* the transistors, so when Q2 is turned on, it is turned on to full saturation.

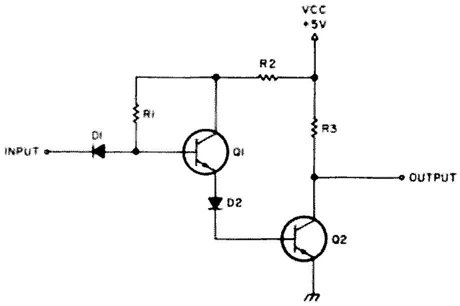

Fig. 3. DTL (diode-transistor logic) offers better speed than RTL. A typical DTL inverter is shown here.

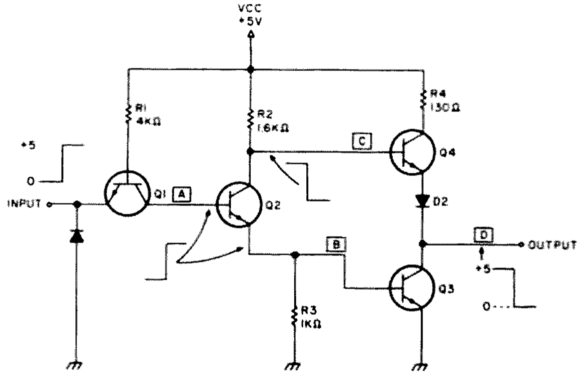

Fig. 4(a). The TTL (transistor-transistor logic) family has LOW values ranging from 0 to 0.8 volts. HIGH is 2.4 to 5.0 volts. An inverter is shown here.

This condition means that the output of the inverter, which is the collector terminal of Q2, goes nearly to ground. The actual voltage $V_{ce(sat)}$ of the transistor is on the order of a few tenths of a volt at most.

When the input is LOW, the cathode of D1 is grounded. Since D1 is now forward-biased, the base of Q1 is essentially grounded. Under this condition, Q1, D1, and Q2 are reverse-biased. With Q2 cut off, then, the output voltage rises to that of Vcc (+). Most DTL devices carry part numbers in the MC800 and MC900 ranges (Motorola designation).

TTL Devices

Probably the most widely used digital IC logic family is the transistor-transistor logic (TTL) family. When most people speak of digital ICs, it is the TTL family of devices to which they refer. Most TTL devices carry type numbers in the 7400 range. (Those devices in the 5400 range are military equivalents to the 7400-series, i.e., a 5447 is a 7447 in uniform. The principal difference between the 5400 and 7400 devices is in the operating temperature range—0 to 80° C for com-

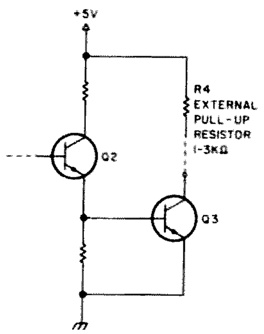

Fig. 4(b). An open-collector TTL circuit results when the output circuit is simplified. An external resistor is needed between the output and +5 volts.

mercial devices and −55 to +125° C for military devices.)

Fig. 4(a) shows the circuit for a typical TTL inverter IC. Like the DTL device, the TTL input acts as a *current source* while the output acts as a *current sink*. The typical TTL input will source 1.8 mA and will be LOW if the voltage is 0 to 0.8 volts and HIGH if 2.4 to 5.0 volts are applied. Performance at values of input potentials between 0.8 and 2.4 volts is not defined, so operation of the devices is unpredictable.

When the TTL input is HIGH, Q1 is cut off, so point A goes HIGH. This condition turns on Q2, forcing point B HIGH and C LOW. We find, then, Q3 is turned on and Q4 is off. This forces the output LOW. Again, the transistors are operated either totally cut-off or totally saturated-on.

If the input is LOW, then exactly the opposite situation occurs: Q1 is turned on (forcing point A LOW), Q3 is off, and Q4 is turned on, i.e., it is connected to Vcc(+).

TTL devices must have a regulated dc power supply of +4.75 to +5.25 volts. In fact, there are some circuits of combinations of devices that require a more limited range of voltages nearer to +5 volts dc. Voltages greater than +5.25 volts often result in a high failure rate of TTL devices.

Some TTL devices are described as being *open-collector* devices. These are essentially the same as regular TTL devices except that the output circuit is modified, i.e., Q4 and D2 are missing. An example of an open-collector circuit is shown in Fig. 4(b). These devices require an external 1k- to 2k-Ohm resistor between the output terminal and the 5-volt dc power-supply line.

Open-collector devices can be useful if you need to tie the outputs of two or more gates together or if you are driving something other than TTL.

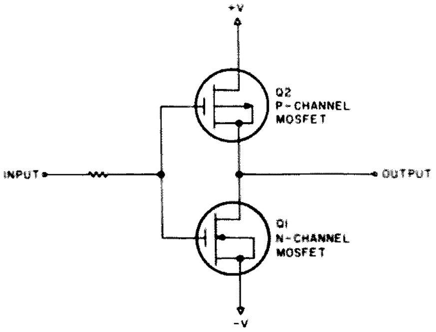

Fig. 5(a). A typical CMOS inverter circuit.

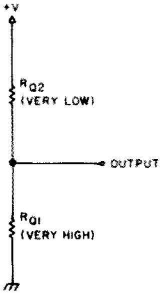

Fig. 5(b). An equivalent circuit for LOW input, HIGH output.

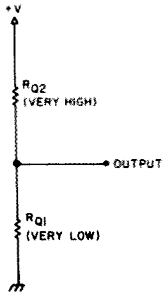

Fig. 5(c). An equivalent circuit for HIGH input, LOW output.

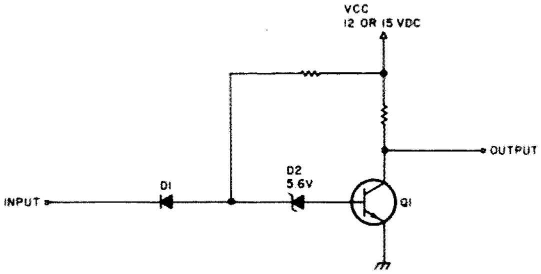

Fig. 6. HTL (high-threshold logic) is useful in applications where noise pulses may be a problem.

CMOS Devices

CMOS IC devices use MOSFET transistors instead of the PNP or NPN bipolar transistors that are used in other logic families. CMOS inputs, therefore, offer a very high impedance. Fig. 5(a) shows a typical CMOS inverter circuit. Note that this family is called *complementary* because the output circuit consists of a complementary pair of MOSFET transistors, i.e., an n-channel and a p-channel in series.

CMOS circuits work over a wide range of voltages, with most devices using a LOW of 0 to 1 volt and a HIGH between 3 and 15 volts. The optimum power supply and HIGH value is usually between 9 and 12 volts. In some instances, a bipolar supply may be used.

CMOS outputs are not directly TTL-compatible, although some specific ICs in the CMOS line are designed to have a TTL-output stage (e.g., the 4049 and 4050 devices). These TTL-compatible devices are often used to directly interface CMOS and TTL devices.

Figs. 5(b) and 5(c) show the equivalent circuits for a CMOS inverter in both possible input conditions, i.e., input HIGH and input LOW. Recall that a p-channel MOSFET turns on when the gate is LOW, while the n-channel device turns on when the gate is HIGH.

Fig. 5(b) shows the situation in which the input is LOW. Transistor Q1 will have a very low (e.g., 200 Ohms) channel resistance. In this case, the output is equivalent to a 200-Ohm resistor to the V+ power-supply line.

In Fig. 5(c), we see the situation in which the input is HIGH. Transistor Q2 now has a very high channel resistance, and Q1 has a very low channel resistance (again, about 200 Ohms). In this case, the output looks like a 200-Ohm resistance to ground, so the output is LOW.

The CMOS ouput stage always looks like a high and low resistor in series across the power supply—see Figs. 5(b) and 5(c). The overall current drain, therefore, is very small.

But CMOS devices do have a problem: They contain MOSFETs, so they are sensitive to static electricity. All A-series CMOS devices (e.g., the 4001A) have this problem, but it is less severe in B-series (e.g., the 4001B) devices. The B-series have built-in diode gate-protection to bypass high static potentials around the sensitive gate structure. Even so, they should be handled with care.

HTL Devices

Noise pulses often are seen by logic circuits as valid input pulses. This problem is especially bothersome in high-speed TTL devices that are normally able to pass high-frequency, short-duration pulses. The solution in noisy environ-

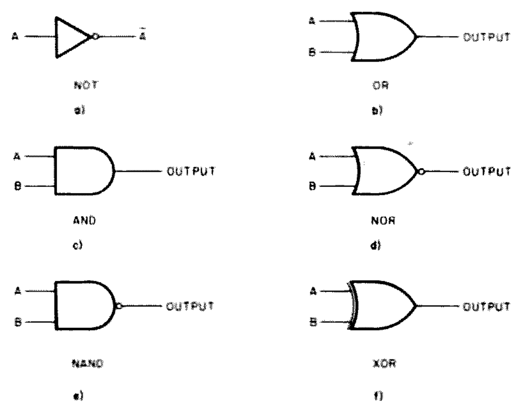

Fig. 7. You can determine the function of a TTL gate by looking at its schematic symbol.

ments is to use a digital IC logic family that requires a high input voltage to trigger. CMOS devices operated at high V− and V+ values meet this requirement, but the older bipolar *high-threshold logic* (HTL) may also be used (Fig. 6).

HTL (also sometimes called *high-noise-immunity logic*, or HNIL) uses V+ values of 12 or 15 volts depending upon the series. As a result, the logic levels also are high, so it requires a bigger noise pulse to cause trouble.

Emitter-Coupled Logic

Up until now we have been talking about *saturated* logic families, i.e., the transistors in the ICs are either all the way on or all the way off (cut off or saturated). *Emitter-coupled logic* (ECL) is called an ac logic family because the transistors are operated in a nonsaturated mode. As a consequence, ECL devices are capable of very fast operation. Most commonplace ECL devices operate to 80 or 120 MHz, while some costly special devices operate to over 1 GHz (that's 1000 MHz!). The usual *prescaler* for a digital frequency counter is nothing more than an ECL frequency divider that divides the 500-MHz input signal down to 50 MHz.

Note that it is necessary to use VHF/UHF circuit design and layout techniques when working with ECL devices. The very high frequencies used are, after all, in the UHF range.

Gates

A digital electronic *gate* is a circuit whose output is HIGH or LOW depending on the input. Gates operate under a set of well-defined rules. The basic forms of digital electronic gates are: NOT, OR, AND, NOR, NAND, and XOR (Exclusive-OR). In the paragraphs to follow, we will discuss all of these basic gates.

NOT Gates

NOT gates, also called *inverters*, produce an output that is the opposite of the input signal. Recall that digital circuits respond only to HIGH and LOW voltage levels. In an inverter circuit, therefore, the output will be HIGH when the input is LOW and LOW when the input is HIGH.

The circuit symbol for the inverter is shown in Fig. 7(a), while the truth table is given in Fig. 8(a). Note that any digital symbol with a *circle* on the output produces an *inverted* output. Similarly, if one or more inputs has a circle on it, then that input is inverted. The rules for the operation of the inverter are:

1) A HIGH on the input produces a LOW output.

2) A LOW on the input produces a HIGH output.

OR Gates

An OR gate will be HIGH if any of its input is HIGH. The symbol for an OR gate is shown in Fig. 7(b), while the truth table is given in Fig. 8(b). The truth table shows the rules of operation for the two-input OR gate, and these are summarized below:

1) If both inputs A and B are LOW, then the output is LOW.

2) If either input A or B is HIGH, then the output is HIGH.

3) If both inputs A and B are HIGH, then the output is HIGH.

AND Gates

The AND gate is the opposite of the OR gate. The AND gate produces a HIGH output only when *all* inputs also are HIGH. The circuit symbol for the AND gate is given in Fig. 7(c), and the truth table is shown in Fig. 8(c). The rules for the operation of the two-input AND gate are:

1) If both inputs A and B are LOW, then the output is LOW.

2) If either input A or B is LOW, then the output is LOW.

3) If both inputs A and B are HIGH, then the output is HIGH.

NOR Gates

The NOR gate is a combination of a NOT gate (inverter) and an OR gate, hence the designation NOR, which means NOT/OR. It is, therefore, an OR gate with an inverted output. The NOR gate is, in fact, sometimes represented in textbooks as an OR gate with an inverter following. The NOR gate symbol, shown in Fig. 7(d), is an OR gate symbol with the circle denoting inversion at the output. The truth table for the two-input NOR gate is shown in Fig. 8(d), and the rules for its operation are summarized below:

(a) NOT

Input	Output
1	0
0	1

(b) OR

Input A	Input B	Output
0	0	0
0	1	1
1	0	1
1	1	1

(c) AND

Input A	Input B	Output
0	0	0
0	1	0
1	0	0
1	1	1

(d) NOR

Input A	Input B	Output
0	0	1
0	1	0
1	0	0
1	1	0

(e) NAND

Input A	Input B	Output
0	0	1
0	1	1
1	0	1
1	1	0

(f) XOR

Input A	Input B	Output
0	0	0
0	1	1
1	0	1
1	1	0

Fig. 8. Understanding a truth table is the key to using logic devices. The 1 designates a HIGH state and the 0 designates a LOW one.

1) If both A and B inputs are LOW, then the output is HIGH.

2) If either input A or B is HIGH, then the output is LOW.

3) If both inputs A and B are HIGH, then the output is LOW.

NAND Gates

The NAND gate is a NOT/AND gate, i.e., an AND gate followed by an inverter. The symbol for the NAND

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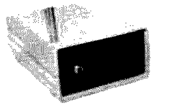

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gate is shown in Fig. 7(e). This symbol is the AND gate symbol with the circle at the output to denote inversion. The truth table for the two-input NAND gate is shown in Fig. 8(e), and the rules are presented in summary below:

1) If both A and B inputs are LOW, then the output is HIGH.

2) If either input A or B is LOW, then the output is HIGH.

3) If both A and B are HIGH, then the output is LOW.

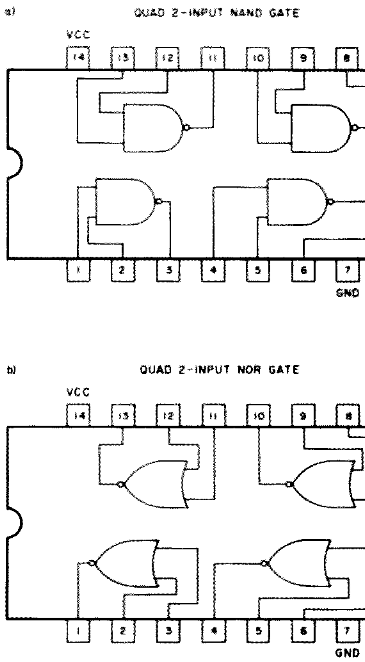


Fig. 9. A chip may contain as many as six individual gates.

XOR Gates

An Exclusive-OR (XOR) gate is like the OR gate discussed earlier except that it will have a LOW output if more than one of its inputs is HIGH. For a HIGH output, there must be one exclusive HIGH input. The XOR gate symbol, shown in Fig. 7(f), is a modified OR gate symbol. The XOR operation is summarized by the truth table in Fig. 8(f) and the rules below:

1) If A and B are both LOW, then the output is LOW.

2) If A is HIGH and B is LOW, then the output is HIGH.

3) If B is HIGH and A is LOW, then the output is HIGH.

4) If A and B are both HIGH, then the output is LOW.

TTL and CMOS Examples

Earlier in this article, I introduced you to several different families of IC digital-logic devices. Of these, several are considered obsolete, so they will not be discussed further. The TTL and CMOS families, however, are very much alive and form the basis of most digital projects today.

TTL/CMOS NAND Gates

In the TTL IC logic family, the most popular NAND gate (and probably the most popular IC) is the 7400 (see Fig. 9). This device contains four two-input NAND gates and usually sells for less than 25¢—or around six cents per gate. Each of the four NAND gates in the 7400 package is an independent entity, but shares the common power supply and ground connections (pins 14 and 7, respectively).

The 7401 and 7403 are similar to the 7400 except that they are open-collector devices. This means that pull-up resistors are needed, i.e., one 2k- to 4k-Ohm resistor from each output to the +5 volt line.

The 7430 is an eight-input NAND gate (one per 14-pin DIP package). The 7430 device, therefore, has eight distinct inputs... and all eight must be HIGH before the output drops LOW. If any one of the eight inputs remains LOW, then the output stays HIGH. Since most microcomputers today are eight-bit machines, the 7430 is often used as an address, or I/O port, decoder.

The 7410 and 7420 are three- and four-input TTL NAND gates, respectively.

In the CMOS line, we also have several different types of NAND gates. The 4011 is a quad two-input NAND gate that is reminiscent of the 7400. The 4012 device is a dual four-input NAND gate. All four inputs of either gate must be HIGH for the respective output to be LOW. The 4023 device is a triple three-input NAND gate, while the 4068 is an eight-input NAND gate.

TTL/CMOS NOR Gates

The 7402 TTL NOR gate is by far the most common example from the TTL line and is almost as popular as the 7400 device. The pinouts for the 7402 are shown in Fig. 9(b)—see 9(a) for pinouts for the 7400, for comparison. Note that the pinouts of the 7400 and 7402 are different, as are their logical responses.

And Now...

We have just gotten our toes wet in the study of digital electronics. In part II, we will progress a little further: We will be up to our ankles in flip-flops. For now, however, you have sufficient information to begin experimenting with flip-flops. ■

The Vertical Deuce

—40 and 75 meters

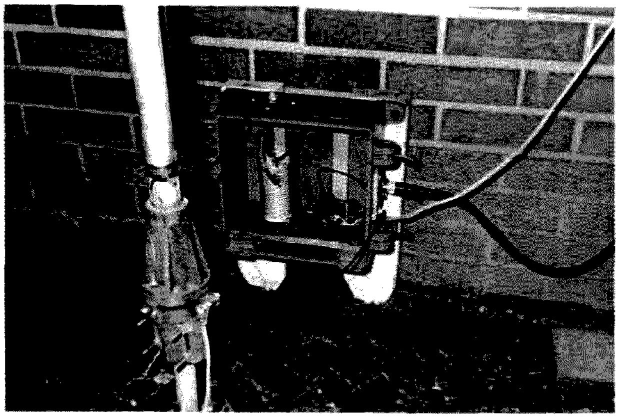
Russ Rennaker W9CRC
1011 Linda Drive
Kokomo IN 46901

There has been much written about antennas, a good portion of which has been about verticals. This is no great scoop and probably has been told in one form or another many times over. It is, however, an easy way to achieve efficiency out of a single antenna for both forty and seventy-five meters.

Of course, the most commonly used method to work multiband on a single antenna is with traps. I have used trapped antennas for many years—allband trapped; twenty, forty, and eighty trapped; ten, fifteen, and twenty trapped; and even forty/seventy-five trapped. I have always experienced many problems with traps, the greatest of all being the limitations in bandwidth, i.e., swr. The method described here solves all of the problems, including bandwidth and high swr.

I have been running a monoband, forty-meter vertical for some time and an additional antenna for seventy-five. After disapproving looks from my neighbors at the half-wave doublet strung from one end of the house to the top of my beam tower, with the coax dangling halfway in between, I decided to do something.

The sketch and the picture tell the rest of the story. The mast I used was 1¼" aluminum tubing, and the height was 29'6" from base insulator to top-hat. The top-hat was made from old TV antenna elements and consisted of eight "spokes," each 24" long. There are several methods of fastening the spokes to the vertical tubing. I used a 5"-diameter piece of aluminum, flattened the end of the tubing, and bolted it to the circular plate. Be sure to use two bolts to ensure that the spokes stay in place and don't swivel out of line.



A close-up of the relay/tuner box showing the #6 wire connected to the base of the aluminum tubing, likewise the ground wire attached to the bottom half of the base.

The coil I used was an old B&W, 2" in diameter, with 20 turns of #12 wire. The tap strap was RG-59/U coax shielding removed from the cable and flattened. It should be as short as possible, and when the final position is determined, it should be soldered to the coil turn solidly. The relay was an old one from the junk box, but anything will do *if* it makes good, solid contact when closed. It could be 110 V ac or some optional dc voltage you might happen to have handy in the shack. Be sure to use correct voltage as indicated by the spec on the coil, since the relay will be closed during all forty-meter usage and we wouldn't want it to get too warm from too much current flowing through it.

Of course, the relay and coil should be enclosed. A metal enclosure did not seem to affect the tuning of the coil in the slightest. I just happened to have an old cast-aluminum box once used in the military for an antenna tuner. It already had a PL-259 connector on one side and a feedthrough insulator on the top. Anything you can come up with will do the trick.

Tuning the antenna is very simple. Since I already had the antenna working on forty meters, no adjustment to length was required. However, if you start from scratch, I suggest you make the mast adjustable by using the top half inserted into the bottom half and a hose clamp to fasten permanently when the correct length is determined. If you are proceeding from scratch, you will want to start with the antenna a little longer than the ultimate will be. Use a grid-dip meter or an in-line swr meter and shorten the mast two or three inches at a time until it resonates in the portion of the forty-meter band you desire. The change-over relay must be closed when tuning the antenna for forty meters—at this point the shorting strap on the coil need not be fastened at all.

Now that we have the antenna working on forty, we will resonate it on seventy-five. I used a CRC 100-uF, 5000-volt capacitor across the coil. This is a tubular capacitor and I suspended it inside the coil, soldering it to each end of the coil. Of course, if you use some other value or the coil size is not the same, you will have to make necessary changes in the tuning procedure.

The procedure I used was to open the relay, leaving the entire coil in series with the forty-meter antenna. See what the resonant point is with all of the coil in. If you can't resonate it at your desired frequency, you will have to either add to the coil turns or to the capacitance. In my case, it resonated below the 3.8 MHz—meaning the coil was too long. I tried the shorting strap two turns down from the top and checked again, but it still was too long. I moved it two turns at a time until I found the correct turn for 3.8 MHz. It turned out to be the fifth turn from the top. I soldered it firmly to that turn, closed the enclosure, and that was it.

I found that at forty meters my antenna had an swr of 1.3 to 1 from 7.1 to 7.3 (making it flat across the phone band) and 1.4 to 1 at 7.0 MHz—just about as good as anyone could expect. On seventy-five the swr was 1.7 to 1 at 3.7 MHz, 1.2 to 1 at 3.8, 1.7 at 3.9, and 1.75 at 4.0 MHz. It sure beats all those unsightly overhead wires.

The control box for the change-over switch is a small 2" × 3½" aluminum item, common in any parts store or out of your junk box at home. The switch is a simple single-throw/single-contact which I found in my junk box. I wired a pilot light across the "on" side so that I could easily tell when the switch was in the forty-meter position. Another color pilot light could be wired across the other side of the switch to indicate it was in the seventy-five-meter position—but I didn't think that was necessary. In addition, I wired the switch to my master switch which turns on the rig, so it would be impossible to leave the relay on when the shack is not occupied. It probably wouldn't hurt it to leave it on all night since it draws little current, but everything in my shack is turned on by a master switch and I made no exception for the relay circuit. ■

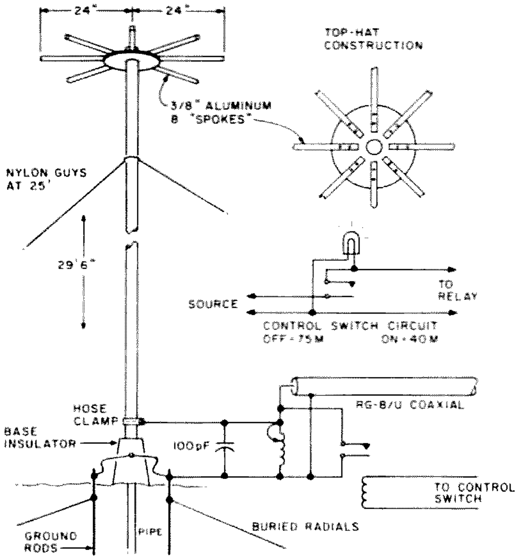


Fig. 1.

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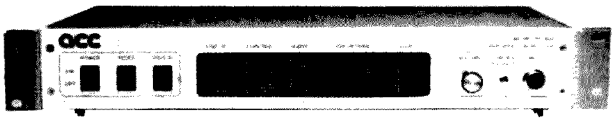

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Several years ago while attending business college at New Mexico State University in Las Cruces, I was bitten by the 2-meter FM bug. There was lots of 2-meter activity in town, and I, being limited in funds, began playing with various types of home-brew antennas. I stumbled on the J-pole section of the ARRL antenna book and began experimenting with various J designs.

I had seen a couple of old-timers using the J antenna made from CB whips and they complained of the J's susceptibility to breakage when whacking trees or other overhead obstructions; they also complained of the difficulty in building a proper balun with which to couple the feedline to the antenna.

In my case, even CB whips were out of my price range, so I cast about for alternatives. I had often noticed the colorful fiberglass "bicycle flags" on the kids' bikes and how much they resembled antennas. I decided to try them. These rods are really very nice for all types of hamming needs. They are sometimes fiberglass and sometimes plastic, and of course the fiberglass ones are the best buy. They seem to cost around $.99 to $5.00 depending on whether they're on sale or not.

I was in love with the J design from the first. The first few I built were tricky to tune and quite fragile, but they worked well. I went through several designs before settling on the present one. I discovered that doing away with the balun arrangements simplified the matching procedure, improved the antenna's performance, and greatly increased the longevity of the antenna (less to break or vibrate loose). As you may discern by looking closely at this antenna, there are several ways to construct it. Use your own imagination and ingenuity to make use of what you have to build it. You might wish to coat the whole antenna assembly with boat varnish or other sealant *after* the coax is attached and tuned satisfactorily.

See Figs. 1 and 2 for assembly details. You may note in Fig. 3 that I use the bike mounting bracket that comes with the pole. If it is mounted as shown, the mount will have a hinge action that will allow the antenna to harmlessly fold back when a low overhead obstruction is encountered, but keep the device erect while driving normally. Also, one of the great advantages of this antenna is

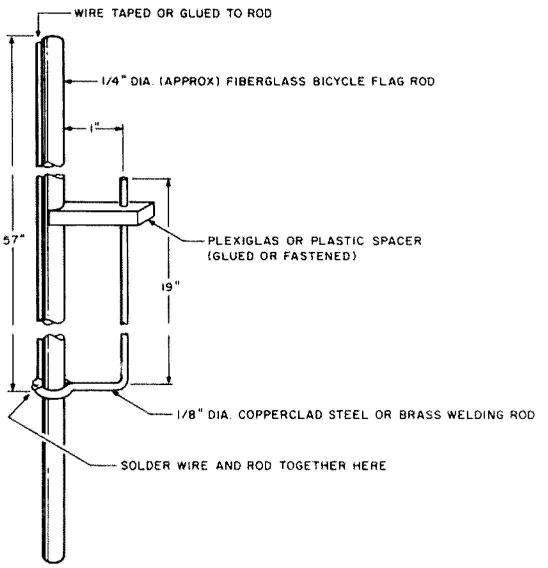


Fig. 1.

that, requiring no ground plane, it may be placed essentially anywhere on the vehicle you wish without adversely affecting its performance. Offered in Fig. 3 are 3 variations in mounting that should adapt to most vehicles. The bolt-action mount saves the antenna (and your car) when you hit tree limbs, etc.

This antenna has several natural applications: motorcycles and bicycles, 18-wheelers and recreational vehicles, backpack frames, as a hand-held for great gobs of gain with portables, bumper or headache-rack mounting on any vehicle, easy mounting on light bars for public safety vehicles, and installation against the window in a motel or apartment!

To adjust the antenna for lowest swr, merely slide the shield and center conductor up and down on the lower portion of the J until the lowest swr point is found. The wire and welding rod need to be scraped and clean for this procedure. Solder the connections when you find the right point. If you have any difficulty, try reversing the shield and center conductor connections. The antenna will work either way as long as you can get it to match properly.

I have compared this antenna to many of my own friends' 5/8-wave 3-dB gain antennas. I haven't seen one yet that this J-pole will not compare to or outperform. Usually the J-pole, mounted or held near the competing antenna's former location, exhibits about an S-unit gain on receiving a weak repeater. Try it sometime. (By the way, one S-unit compares roughly with 1 dB on all the imported radios I've checked.) I keep a spare antenna around the house for motel mobile and it's easy to walk out to a friend's car, get a meter reading on a distant repeater, then remove his antenna and hold the J-pole temporarily near the same spot. Usually the J-pole will have noticeable gain. I theorize the greater height of the J-pole plus the lack of ground sensitivity account for the difference.

I have shown this antenna to several engineer-type friends who shake their heads in disgust over its simplicity and lack of balun, etc. However, they all agree that for some reason it works well . . . and that's what it's all about, isn't it?

It would not be fair to ignore some disadvantages with this antenna. It is *not* as sturdy as most commercially-made antennas. Weather, vibration, wind, and corrosion will necessitate repairing the antenna occasionally—depending on your climate. (Usually the soldered connections give the most frequent trouble. I usually have to repair mine every 9 months or so.) This antenna may exhibit some minor directivity. However, *all* antennas on vehicles are directive to some degree, depending on the mounting location. Depending on the rigidity of your rod, you may find under road speeds the swr changing as the antenna bends backward. I have good luck in mounting the antenna with the stub facing forward or sideways so the spacing of the stub doesn't change as the antenna flexes.

In conclusion, I have presented here a simple, inexpensive, and very effective 2-meter antenna. It can be adapted easily to 220 or 450 use by experimentation and scaling of the dimensions. None of my antennas has ever been stolen and no one has ever asked me if I monitored channel 19. It may be, as some engineers insist, much like a bumblebee (too heavy to fly). However, if you try it, you will agree it works anyway! ■

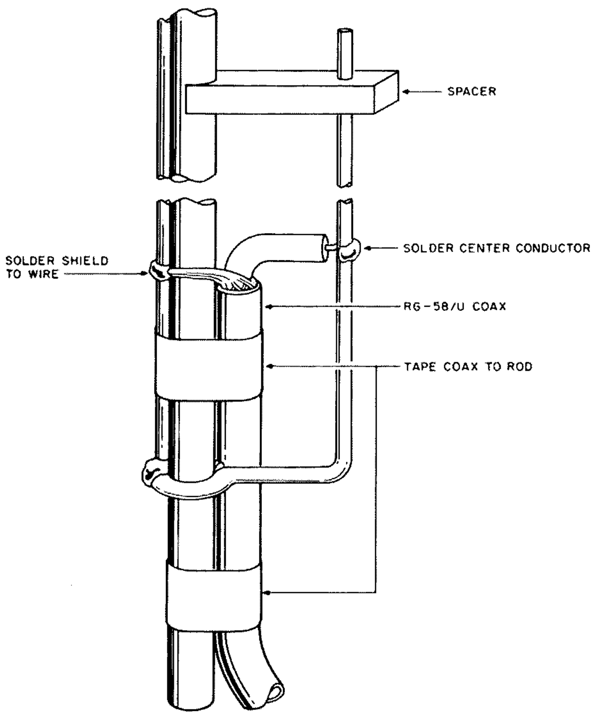


Fig. 2.

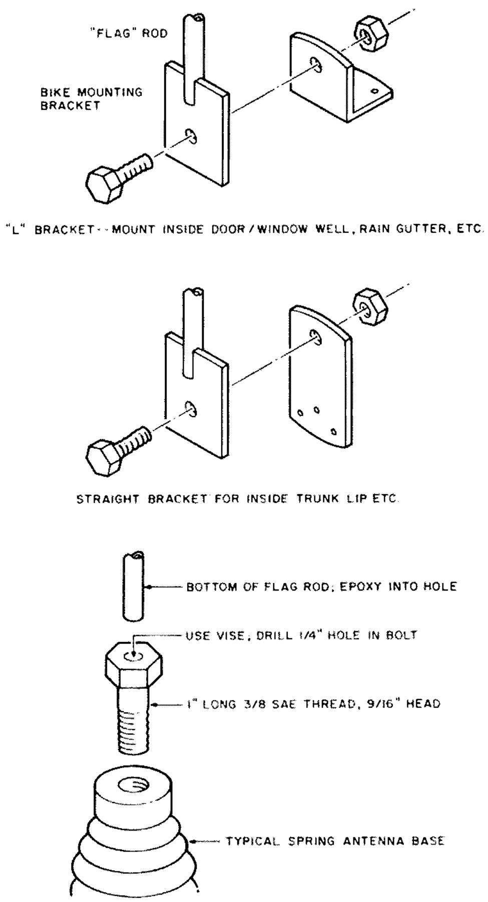


Fig. 3.

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received at 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458.

HARRISBURG PA
SEP 5

The Central Pennsylvania Repeater Association will hold the 9th annual Hamfest/Computerfest on September 5, 1982, beginning at 6:00 am, at the Harrisburg Farm Show parking lot, off the Route 81 Cameron Street exit. (Follow the signs to the Farm Show building.) Registration is $3.00; sellers' 10-foot space, $5.00; tailgating, $1.00. Talk-in on 144.87/5.47, 146.16/.76, and .52. For more information or a map, contact Irvin Sanders K3IUY, RD #3, Box FA53, Harrisburg PA 17112, or phone (717)-469-2185.

HAMBURG NY
SEP 10-11

Ham-O-Rama '82 will be held on Friday and Saturday, September 10-11, 1982, at the Erie County Fairgrounds near Buffalo NY. Hours are 6:00 pm to 9:00 pm on Friday and 7:00 am to 5:00 pm on Saturday. Advance tickets are $3.50 (deadline: September 1st) and tickets at the gate will be $4.50. Children under 12 will be admitted free. The outside flea market is $3.00 per space and the inside flea market is $10.00 per space. Features will include new equipment displays, computers, technical programs, ladies' programs, and valuable awards. Talk-in on 146.31/.91. For advance tickets, send an SASE to Dave Baco WA2TVT, 130 Vegola Avenue, Cheektowago NY 14225.

AUGUSTA ME
SEP 10-12

The Augusta Emergency Amateur Radio Unit will hold the ARRL-approved Northeast Area Hamfest on September 10-12, 1982, at Windsor Fairgrounds, located just off Route 17, 10 miles east of Augusta ME. Facilities for campers will be available. Activities will include a flea market and regularly scheduled speakers and demonstrations, as well as the usual events. Talk-in on 146.22/.82 and .3940.

AUGUSTA NJ
SEP 11

The Sussex County Amateur Radio Club will hold its fourth annual SCARC '82 hamfest on Saturday, September 11, 1982, at the Sussex County Farm and Horse Show grounds, Plains Road off Rte. 206, Augusta NJ, just north of Newton. Pre-registration for outdoor flea-market sellers is $4.00; at the gate, $5.00. Pre-registration for indoor flea-market sellers is $5.00; at the gate, $6.00. Other registration is $2.00. There will be door prizes and acres of free parking. Talk-in on 147.90/.30 and 146.52. For additional information or pre-registration, write Sussex County Amateur Radio Club, PO Box 11, Newton NJ 07860, or Lloyd Buchholtz WA2LHX, 10 Black Oak Drive, Vernon NJ 07462.

UNIONTOWN PA
SEP 11

The Uniontown Amateur Radio Club will hold its 33rd annual gabfest on Saturday, September 11, 1982, on the club grounds located on the Old Pittsburgh Road, just off Route 51 and the 119 bypass, Uniontown PA. The pre-registration fee is $2.00 each or 3 for $5.00. There will be free parking, free coffee, and free swap and shop setups with registration. Prizes will be awarded, including a first prize of a Ten-Tec Argosy 525 HF. Featured will be a DX contest, demonstrations, and refreshments. Talk-in on 147.045/.645, 144.57/145.17 and 146.52/.52. For further information, contact UARC Gabfest Committee, c/o John T. Cermak WB3DOD, PO Box 433, Republic PA 15475, or phone (412)-246-2870.

MARION IN
SEP 11

The Grant County Amateur Radio Club Hamfest will be held on Saturday, September 11, 1982, at McCarthy Hall, Marion IN, from 8:00 am until 4:30 pm. Admission is $2.00 in advance and $3.00 at the gate. There will be good home cooking, hourly drawings, and major prizes. Talk-in on 146.19/.79 and 146.52. For more information or tickets, send an SASE to Beecher Waters WB9YHF, RR #1, Box 357, Converse IN 46919.

MELBOURNE FL
SEP 11-12

The Platinum Coast Amateur Radio Society will hold its 17th annual hamfest and indoor swap-and-shop flea market on September 11-12, 1982, at the Melbourne Auditorium, Melbourne FL. Admission is $3.00 in advance and $4.00 at the door. Swap tables are $10.00 for one day and $15.00 for both days. There will be unlimited free parking, a tail-gate area, air-conditioned swap and exhibit area, awards, forums, and meetings. Talk-in on .25/.85 and .52/.52. For reservations, tables, and information, write PCARS, PO Box 1004, Melbourne FL 32901, or call (305)-245-5116.

WARNER ROBINS GA
SEP 11-12

The Central Georgia Amateur Radio Club (CGARC) will hold the fourth annual Central Georgia Hamfest and ARRL Georgia State Convention on Saturday and Sunday, September 11-12, 1982, at the Warner Robins Recreation Center, 800 Watson Boulevard, Warner Robins GA. Donation tickets will be available at the door for $1.00 each, 6 for $5.00, or 13 for $10.00. There is no registration fee. Indoor or outdoor flea market space is $3.00 per day (bring your own table). Features will include meetings, forums, a Sunday morning breakfast for the Georgia State CW Association, activities for YLs and harmonics, a Friday night hospitality room, and Saturday night pickin' and grinnin'. Talk-in on 146.25/.85. For more information, contact Jim Piper W4HON, 618 American Boulevard, Warner Robins GA 31093.

BUTLER PA
SEP 12

The Butler County Amateur Radio Association will hold its annual hamfest on Sunday, September 12, 1982, from 9:00 am to 4:00 pm, at the Butler Farmshow Grounds at Roe Airport, Butler PA. Fly-in at Butler Farmshow Airport. Admission is a $1.00 donation and children under 12 will be admitted free. Overnight campers are welcome and food and refreshments will be available. There will be an indoor flea market (vendor space will be $3.00 per 8-foot table), a free outside flea market, free parking (including for the handicapped), and prizes, including a Kenwood TS-830S HF transceiver. Talk-in on 147.96/.36, .52, and 147.84/.24. For additional information, contact Leighton Fennell, Crestmont Drive, RD 6, Butler PA 16001, or phone (412)-586-9822.

WILLIMANTIC CT
SEP 12

The Natchaug Amateur Radio Association will hold a giant flea market on Sunday, September 12, 1982, from 9:00 am until 4:00 pm, at the Elks home, off Rtes. 32 and 6, Willimantic CT. Tables may be reserved in advance for $5.00 until September 1st; after that date, they will be $7.00 at the door. Admission is $1.00. There will be free parking, as well as raffles and door prizes. Talk-in on 147.30 and 147.90/.50. For further information, contact Clifton Pease KA1HYW, 268 Main Street, Willimantic CT 06226, or phone (203)-456-1432 after 4:00 pm.

CARTERVILLE IL
SEP 12

The Shawnee Amateur Radio Association will hold its 28th hamfest, SARAFEST '82, on Sunday, September 12, 1982, at John A. Logan College, Highway 13, Carterville IL. Admission is $2.00 in advance and $3.00 at the door. There will be an air-conditioned flea market, forums, computers, refreshments, contests, and prizes, including a first prize choice of a Kenwood 130S HF transceiver, a microwave oven, an RCA color TV, or an automatic dishwasher. Talk-in on 146.25/.85, 146.52, and 3.925. For further information, contact William May KB9QY, 800 Hilldale Avenue, Herrin IL 62948, or phone (618)-942-2511 days.

PORT JEFFERSON LI NY
SEP 12

The Suffolk County Radio Club will hold the 5th annual flea market on Sunday, September 12, 1982, at the Odd Fellows Hall, Jayne Boulevard, Port Jefferson Station NY. The rain date will be September 19th. Admission for buyers is $1.50 each and YLs, XYLs, and harmonics will be admitted free. Sellers, including car and driver, will be charged $3.50 each. There will be raffles and food and drink, plus drawings for door prizes. Talk-in on 145.21/144.61. For additional information, contact Floyd WA2SDI at (516)-234-9376 after 6:00 pm.

GRAND RAPIDS MI
SEP 18

The Grand Rapids Amateur Radio Association, Inc., will hold its annual swap and shop on Saturday, September 18, 1982, at the Hudsonville Fairgrounds. There will be prizes and dealers, with an indoor sales area and an outdoor trunk swap area. Gates will open at 8:00 am for both swappers and the public. Talk-in on 146.16/.76. For more information, write Grand Rapids Amateur Radio Association, Inc., PO Box 1248, Grand Rapids MI 49501.

PEORIA IL
SEP 18-19

The Peoria Area Amateur Radio Club will hold the Peoria Superfest '82 on September 18-19, 1982, at the Exposition Gardens, W. Northmoor Road, Peoria IL. The gate opens at 6:00 am; the commercial building at 9:00 am. Admission is $3.00 in advance or $4.00 at the door. Activities include forums, amateur radio and computer displays, a free flea market, and, on Saturday evening, an informal get-together at the Heritage House Smorgasbord. At the hamfest site, there will be free movies Saturday night. Full camping facilities are available, as well as a Sunday bus to Northwoods Mall for the ladies. Talk-in on 146.16/.76. For more information, contact Charles W. Kuhn WD9EGW, PAARC Director, 7005 N. Tobi Lane, Peoria IL 61614.

MT CLEMENS MI
SEP 19

The L'Anse Creuse Amateur Radio Club will hold its 10th annual swap and shop on Sunday, September 19, 1982, from 9:00 am to 3:00 pm, at the L'Anse Creuse High School, Mt. Clemens MI. Take I-94 eastbound to the Metropolitan Parkway exit; then take the Metropolitan Parkway to Crocker; go left on Crocker to Reimold and then right on Reimold to the last school, L'Anse Creuse High School. Admission is $2.00 at the door or $1.00 in advance. FCC representatives will be there, as well as plenty of new and used gear. There will be lots of food and parking, plus hourly prize drawings. Prizes include a first prize of $250, a second prize of $100, and a third prize of $50. Talk-in on 147.69/.09 and 146.52. For more information, send an SASE to Maurice Schietecatte N8CEO, 15835 Touraine Ct., Mt. Clemens MI 48044.

AUGUSTA GA
SEP 19

The Augusta Amateur Radio Club will hold its annual hamfest on September 19, 1982, at the Julian Smith Casino in Augusta GA. Admission is $3.00 per person; tailgating will be $2.00. There will be prizes, a barbecue, bingo, and a hospitality room on September 18th from 4:00 pm to 11:00 pm at the Ramada Inn West, Rooms 108-110. Talk-in on 147.72/.12. For more information, contact John Schumacher N4DOU, PO Box 3072, Augusta GA 30904, or phone (404)-860-4460 from 6:00 pm to 9:00 pm EDT.

PENNSAUKEN NJ
SEP 19

The South Jersey Radio Association will hold its 1982 annual hamfest on Sunday, September 19, 1982, from 8:00 am to 4:00 pm, at Pennsauken High School parking lot, Route 73 and Remington Avenue, Pennsauken NJ. There will be door prizes, food, and fun. Admission is $3.00; tailgate sales are $5.00. Talk-in on 146.220/146.820 and 146.52. For ticket sales and more information, contact Fred Holler W2EKB, 348 Bortons Mill Road, Cherry Hill NJ 08034.

VENICE OH
SEP 19

The Forty-Fifth Annual Cincinnati Hamfest will be held on Sunday, September 19, 1982, at Stricker's Grove, State Route 128, Venice (Ross) OH. Admission and prize ticket, $5.00. There will be exhibits and booths, prizes, a flea market (radio-related products only), a hidden transmitter hunt, and an air show. Food and refreshments will be available. For further information, write Lillian Abbott K8CKI, 317 Greenwell Road, Cincinnati OH 45238.

MONTGOMERY AL
SEP 19

The Central Alabama Amateur Radio Association will hold its 5th annual hamfest on Sunday, September 19, 1982, at the Civic Center, downtown Montgomery AL. There will be free admission, free parking, and 22,000 square feet of air-conditioned

activities, including a flea market. Setup will be at 0600, doors will be open from 0800 to 1500, and a prize drawing will be held at 1400 CDST. Restaurants and motel accommodations are located within a short walk of the Civic Center and refreshments will be available in the Civic Center. Talk-in on 146.04/.64, 146.31/.91, 147.78/.18, or 147.045/ ± 600T. For further information or market reservations, write Hamfest Committee, 2141 Edinburgh Drive, Montgomery AL 36116, or call Phil at (205)-272-7980 evenings.

NEW KENSINGTON PA
SEP 19

The Skyview Radio Society will hold its annual hamfest on Sunday, September 19, 1982, from noon until 4:00 pm, at the club grounds on Turkey Ridge Road, New Kensington PA. Registration fee is $2.00; vendors, $4.00. There will be awards. Talk-in on .04/.64 and .52.

NEWTOWN CT
SEP 19

The Candlewood Amateur Radio Association will hold a flea market and auction on Sunday, September 19, 1982, rain or shine, at the Essex House, Rte. 6, exit 8 off I-84, Newtown CT, from 10:00 am to 4:00 pm. Admission fee of $1.00 includes one door prize chance. Tables are $6.50. Featured will be an equipment raffle of a TR-2500 handie-talkie, dealers, and a magic show for the kids. Refreshments will be available. Talk-in on 147.72/.12. For advance table reservations, write CARA, PO Box 188, Brookfield Center CT 06805. For more information, call George WB2THN at (914)-533-2758, Ken KA1GDS at (203)-744-6953, or George AF1U at (203)-438-0549.

ELMIRA NY
SEP 25

The Elmira Amateur Radio Association will hold the seventh annual Elmira International Hamfest on September 25, 1982, at the Chemung County Fairgrounds. Breakfast will be available for several hours after the gates open at 6:00 am. Advance tickets are $2.00 and tickets at the gate are $3.00. Featured will be tech talks, a free flea market, dealer displays, and prizes, including a grand prize of an Icom IC-730. Friday night camping will be available on a limited basis at the fairgrounds and lunch will be available starting at 11:00 am on Saturday. Talk-in on 147.96/.36, 146.10/.70, and 146.52. For advance tickets, write John Breese, 340 West Avenue, Horseheads NY 14845.

WICHITA FALLS TX
SEP 25-26

The Wichita Amateur Radio Society will hold its first annual hamfest on September 25-26, 1982, at the National Guard Armory, Wichita Falls TX. Pre-registration closes Wednesday, September 22, 1982, and is $4.00 per person and $3.00 per swap table. Registration at the door is $5.00 and starts at 8:00 am on Saturday and Sunday. There is free shuttle service from the Kickapoo Airport (¼ mile south), free RV parking without hookups at the armory, and a concession stand open both days. There will be dealer displays, an inside flea market with 24-hour security, scheduled ladies' activities and prizes, contests, meetings, a grand prize, and other prize drawings. Talk-in on 146.34/.94 and 147.75/.15. For more information and pre-registration, write to WARS Hamfest, PO Box 4363, Wichita Falls TX 76308.

GRAYSLAKE IL
SEP 25-26

The Chicago FM Club will hold the 12th annual Radio Expo on September 25-26, 1982, from 9:30 am to 4:00 pm, at the Lake County Fairgrounds at the intersection of Rtes. 45 and 120, Grayslake IL. Admission is $3.00 in advance and $4.00 at the door. There will be displays, seminars, technical talks, a flea market (open from 6:00 am to 6:00 pm), full food services, a free camping area, acres of free parking, ladies' programs, children's events, and prizes. Talk-in on 146.16/146.76 and 222.52/224.10. For more information and/or reservations, contact Harold G. Rowlett, c/o Radio Expo, PO Box 1532, Evanston IL 60204, or phone (312)-588-3976.

BEREA OH
SEP 26

The Cleveland Hamfest Association will present the 8th annual Cleveland Hamfest on Sunday, September 26, 1982, at the Cuyahoga County Fairgrounds in Berea OH, from 0800 to 1700 hours. Activities will include indoor exhibits, forums, a ladies' program, and an outdoor flea market with separate parking. Food services will include both breakfast and lunch. There will be three main prizes and a mobile check-in prize. Talk-in on 146.52. Advance tickets are $2.50 prior to August 31st and $3.00 at the door. For more information, contact the Cleveland Hamfest Association, PO Box 27211, Cleveland OH 44127.

NEW LONDON NH
SEP 26

The 6th annual Connecticut Valley FM Association Hamfest/Flea Market will be held on Sunday, September 26, 1982, from 9:00 am to 5:00 pm, at King Ridge Ski Area, New London NH. Adult admissions are $2.00, a flea-market setup is $5.00, and children under 16 will be admitted free. King Ridge will have the food concession. For more information, contact Francis Callahan KA1BWE, Box 173, East Wallingford VT 05742.

ADRIAN MI
SEP 26

The Adrian Amateur Radio Club will hold its 10th annual hamfest on Sunday, September 26, 1982, at the Lenawee County Fairgrounds, Adrian MI. Talk-in on 146.31/.91 (W8TQE). For tickets, tables, and more information, contact the Adrian Amateur Radio Club, Inc., PO Box 26, Adrian MI 49221.

GAINESVILLE GA
SEP 26

The 9th annual Lanierland ARC Hamfest will be held on September 26, 1982, beginning at 9:00 am, in the Holiday Hall at Holiday Inn, Gainesville GA. There will be free tables and an inside display area for dealers and distributors (doors will open at 8:00 am for dealer setups). Prize tickets are $1.00 each or 6 for $5.00. Food and drink will be available, as well as a large parking lot for a free flea market. A boat anchor auction will be held and all activities and facilities will be free. Talk-in on 146.07/.67. For information and free space to dealers, contact Phil Loveless KC4UC, 3574 Thompson Bend, Gainesville GA 30506, or phone (404)-532-9160.

BOXBORO MA
OCT 2-3

The Federation of Eastern Massachusetts Amateur Radio Associations will hold the New England ARRL Convention on October 2-3, 1982, at the Sheraton Boxboro Hotel, Route 495 at Route 111, Boxboro MA. On Saturday the hours will be 9:00 am to 5:00 pm and on Sunday, 10:00 am to 5:00 pm. Early-bird registration is $4.00. The Saturday evening banquet, dance, and show is $13.50. Features will include a Wouff Hong midnight ceremony Saturday and YL programs on both days. For reservations and advance registration, send an SASE to Arthur Tomkinson W1THT, 9 Oliver Terrace, Revere MA 02151 and make checks payable to FEMARA.

WARRINGTON PA
OCT 2-3

The Pack Rats sixth annual Mid-Atlantic VHF Conference will be held on Saturday, October 2, at the Warrington Motor Lodge, Rte. 611, Warrington, PA. Advance registration $3.00; at the door, $4.00. Price includes admission to the 11th annual Pack Rats Hamarama on Sunday, October 3, at the Bucks County Drive-In Theater, Rte. 611, Warrington, PA. Admission to the flea market $2.00 and tailgating $4.00 per space. Bring your own table. Gates open at 7:30 am. Talk-in via W3CCX on 146.52. Information for both events is available from Hamarama '82, POB 311, Southampton PA 18966 or Lee A. Cohen K3MXM at (215)-635-4942.

ROCK HILL SC
OCT 3

The York County Amateur Radio Society will hold its 31st annual hamfest on Sunday, October 3, 1982, at Joslin Park, Rock Hill SC, starting at 0700. Pre-registration is $3.00; at the gate, $4.00. There will be prizes. Talk-in on 146.43/147.03 and 146.52. For additional information, contact YCARS, Box 4141 CRS, Rock Hill SC 29730.

YONKERS NY
OCT 3

The Yonkers Amateur Radio Club will hold its electronics fair and flea market on Sunday, October 3, 1982, from 9:00 am to 5:00 pm, rain or shine, at Yonkers Municipal Parking Garage, corner of Nepperhan Avenue and New Main Street. Admission is $2.00 each; children under 12 will be admitted free. Sellers' spaces are $6.00 (bring your own table) and include one admittance. Gates will be open to sellers at 8:00 am. There will be live demonstrations, hourly prizes, an auction, free parking, refreshments, and unlimited free coffee all day. Talk-in on 146.265/146.853, .52, or CB channel 4. For further information, write YARC, 53 Hayward Street, Yonkers NY 10704, or phone (914)-969-1053.

VIRGINIA BEACH VA
OCT 9-10

The ARRL Virginia State Convention and Tidewater Computer Show-Hamfest-Electronic Flea Market will be held on Saturday and Sunday, October 9-10, 1982, from 9:00 am to 5:00 pm both days, at the pavilion in Virginia Beach VA. Admission is $3.50 for both days. Flea-market tables are $5.00 for one day or $8.00 for both days; commercial flea-market tables are $15.00 for both days, and commercial booths are $30.00 for both days. Featured will be dealers, special displays, forums, computers, satellite equipment, special XYL programs, and a cocktail party Saturday night. There will be an advance ticket drawing for a hand-held transceiver, as well as many valuable door prizes. For more information and/or tickets, contact Jim Harrison N4NV, 1234 Little Bay Avenue, Norfolk VA 23503, or phone (804)-587-1695.

ASHEVILLE NC
OCT 9

The Western North Carolina Amateur Radio Society will hold its seventh annual Autumnfest on October 9, 1982, at the Asheville Civic Center, Asheville NC. Admission is $3.00 in advance and $4.00 at the door. Flea market tables will be $5.00 at the door. Activities (all indoors) will include the McElray Memorial CW Competition, bingo for the ladies, and dealer and flea market tables. Travel, motor home, and camping facilities will be available. Talk-in on .31/.91, .16/.76, and .52. For more information, contact WCARS, PO Box 1488, Asheville NC 28802.

PARAMUS NJ
OCT 10

The Bergen ARA will hold a ham swap 'n sell on October 10, 1982, from 8:00 am to 4:00 pm, at Bergen Community College, 400 Paramus Road, Paramus NJ. Buyers will be admitted free and sellers will be charged $3.00. There will be tailgating only; bring your own table. Thousands of spaces will be available. Talk-in on .79/.19 and .52. For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

LIMA OH
OCT 10

The Northwest Ohio Amateur Radio Club will hold its sixth annual hamfest on Sunday, October 10, 1982, at the Allen County Fairgrounds, Lima OH. Indoor flea market tables will be available for $5.00 for an 8-foot table or $3.00 for half a table. Tickets are $2.50 in advance, $3.00 at the door. Doors will open at 6:00 am and grand prizes will be drawn at 3:00 pm. Overnight camping will be available at the fairgrounds. Talk-in on .07/.67, .63/.03, .34/.94, and .52/.52. For more information, write NOARC, Box 211, Lima OH 45802.

BALTIMORE MD
OCT 10

The Columbia Amateur Radio Association will hold its 6th annual hamfest on Sunday, October 10, 1982, from 8:00 am to 3:30 pm, at the Howard County Fairgrounds (15 miles west of Baltimore, just off I-70 on Rt. 144, 1 mile west of Rt. 32). Admission is $3.00, tables are $6.00, tailgating is $3.00, and indoor tailgating is $5.00. Food will be available and prizes will be awarded. Talk-in on 147.735/.135 and 146.52/.52. For table reservations or information, write Sue Crawford, 6880 Mink Hollow Road, Highland MD 20777, or phone (301)-286-3805.

WAUKESHA WI
OCT 10

The Kettle Moraine Radio Amateur Club will hold its annual Ham, Computer, Video Fest on Sunday, October 10, 1982, at the Waukesha County Expo Center, Highways F and FT, Waukesha WI. Tickets are $2.00 in advance and $3.00 at the door. Tables are $3.00 for each 4-foot length; reservations will be accepted until October 1, 1982. Since all facilities will be indoors, the hamfest will be open rain or shine, beginning at 8:00 am. There will be prizes, food, commercial exhibitors, a "happy hour," and free parking. For table reservations, send a check payable to KMRA Club, PO Box 411, Waukesha WI 53187.

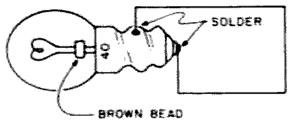
CHELSEA MA
OCT 17

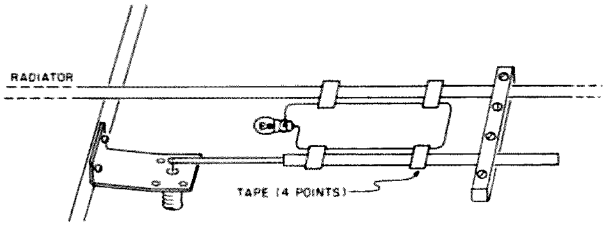
The 19-79 Repeater Association of Chelsea MA will hold its annual flea market on Sunday, October 17, 1982, from 11:00 am to 4:00 pm (sellers admitted at 10:00 am), at the Beachmont VFW Post, 150 Bennington Street, Revere MA. Admission is $1.00. Sellers' tables are $6.00 in advance and $8.00 at the door, if available. Talk-in on .19/.79 and .52. For table reservations, send a check to 19-79 Repeater Association, PO Box 171, Chelsea MA 02150.

CIRCUITS

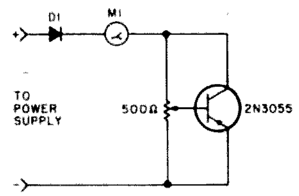
Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73* Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*

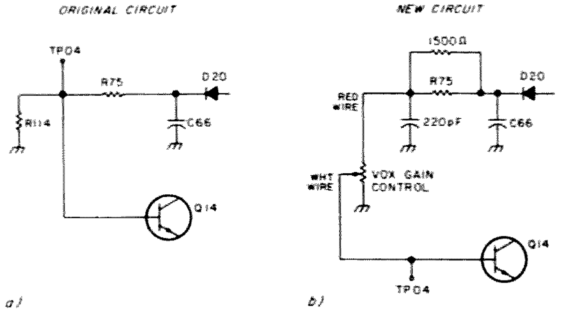




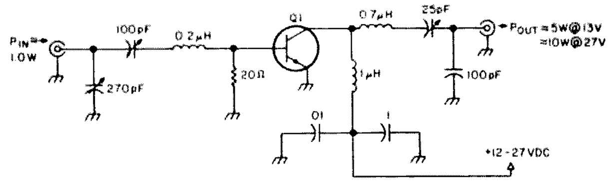
VISUAL ADJUST FOR GAMMA MATCH: In an emergency or when you don't have your swr meter handy, you can still adjust a gamma match with good results by doing the following: Make a rectangular "Hertz loop" (see diagram) by soldering a piece of solid hookup wire to a 6.3-V, 150-mA, no. 40 pilot lamp. You may use a socket if desired. The loop is the same height as the gamma and about half the width. If the exciter is QRP, it may be necessary to increase the width of the loop a bit. Fix it to the gamma with masking tape and excite the antenna with about 10 Watts (or enough power for the lamp to start to glow). Adjust the gamma for maximum brightness of the lamp. If the lamp becomes too bright, you may decrease the coupling between the Hertz loop and the gamma by bending one end of the loop slightly away from the match. Caution: Do not touch the antenna with the power on. After adjusting for maximum brightness, remove the loop and the antenna is matched. Even if you use an swr meter at the transmitter end of the scale, it may falsely indicate a perfect match with certain lengths of coax. However, if you also use the Hertz loop, it quickly verifies that the gamma is adjusted for maximum power transfer.—Jose Vicente PY2AUC, Campinas, SP, Brazil.



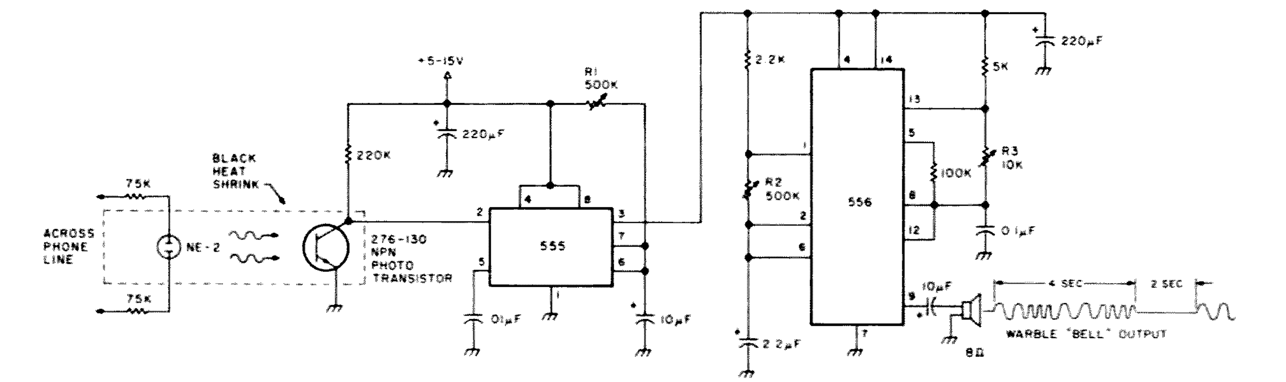
DUMMY LOAD FOR POWER SUPPLIES: The series pass transistor is used as a variable resistor and will handle up to 15 Amperes or 115 Watts. The base bias is set by the resistor so that the conduction can be varied. The transistor will get rather hot. It must be mounted on a heat sink and should have forced cooling if heavy loading is anticipated.—Glen Deibart, APO NY.



NOISE-BLANKER MODIFICATION FOR THE YAESU FT-707: Fig. (a) is the original circuit in which full gating is used. Fig. (b) shows the new circuit which employs variable gating on Q14, improving the suppression of ignition noise. I had no need for the VOX control, so I disabled it and used the potentiometer for the noise-blanker gate control. Results were very good; adjust the control until the ignition noise and strong adjacent signals disappear.—Carl Weiche W5NLB, Tulsa OK.



SIX-METER AMPLIFIER: This class C six-meter amplifier produces a respectable signal when driven with about one Watt from a military GRC or PRC FM transceiver or a conventional amateur transmitter. The CB transistor operates only slightly warm with two square inches of heat sink. The Q of the output network is 7 when operated at 13 volts. The input network Q is 3.5.—Al McKenna WB6BSP, Healdsburg CA.



ELECTRONIC PHONE BELL: The speaker emits a distinctive warble tone when ring pulses are applied to the phone line. Use this circuit as a remote bell or disconnect the phone's ringer for direct use. R1 adjusts the duration of the output; R2 and R3 control the tone's duty cycle and frequency. The transistor is a general-purpose NPN photodevice. The neon bulb and transistor are coupled with the heat-sink tubing to form an optoisolator.—John Mairs AA4DX, Springfield VA.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I am looking for a schematic for a keyboard manufactured by Incoterm Corp., assembly 055-13-02-70REV. I am also looking for any information on how to interface this keyboard to a RTTY or microprocessor system.

W. G. Mott
2 London Bridge
London SE1 8RB
England

I would like to hear from somebody who can repair a Digital Frequency Display, Model DD-1K.

J. M. Garcia KP4EE
PO Box 66
Aguadilla PR 00605

I am looking for a schematic for a 1934 Philco table-model Type 89, Code 123, Ser. No. D-15143.

Charles Owens
Denbow Rd.
Durham NH 03824

I am looking for a Central Electronics 200-V transmitter in any condition or parts for the same.

Ted Wilson KA7LVT
12439 So. Giles St.
Las Vegas NV 68124

Wanted: OS8N oscilloscope, a Sencore TC28 tube tester hybridster, Ameco R5 receiver, and a Knight Kit vfo. Please state price and condition.

Kevin Neal
Rte. A, Box 221A
Flippin AR 72634

Looking for equipment donations to help initialize a ham club station at a recently-opened veterans home. All donations accompanied by a note giving approximate values will be accordingly acknowledged since they are tax deductible.

David Basham AE8Y
Chief, Social Services
Barboursville Veterans Home
512 Water St.
Barboursville WV 25504

Schematics or manuals on the following would be appreciated:
- Hallicrafters SX 104-30-50MC receiver.
- Precision Applications E400 series sweep generator.
- Knight capacitance checker.
- Tektronix 541-535 O-Vert plug-in.
- Military OS-8U oscilloscope, PS1J power supply, and P1B2X8J oscilloscope.
- Electalarm Model ID60 alarm by Nuclear Electronics Corp.
- American Telephone alarm, Model AE 202UL, c/o ATA Controls Systems.
- Sears Micromatic IC cassette tape recorder.

Costs for postage and/or copying will be paid, but let me know them first.

Kevin Neal
Rte. A, Box 221A
Flippin AR 72634

I need a schematic and manual for the IC-2F VHF 2-meter transceiver and a schematic for the IC-3P power supply 3375, made in 1970.

Harold Nelson WB9QMX
401 East Wisconsin Ave.
Silver Lake WI 53170

I need the dimensions for the CW radials for the Hy-Gain 18AVTWB antenna.

Sam Creason K6EW
2940 Arlington Ave.
Fullerton CA 93635

I need information and schematics for a Phonics TV phone, part #690-56331, manufactured by AMF Electronics Products Div., in Herndon, Virginia. I am also looking for information on converting a J.I.L. 202SSB CB to 10 meters. I will pay for any copying costs involved.

Jeff Parker WA1WXL
2001 Jack Frost Rd.
Virginia Beach VA 23455

I need information/schematic/instruction manual for the Bu Ships LM-21 xtal calibrator, freq. indicating 125-20,000 kHz, type 74028-A. I would also like some information on building a suitable power supply for this unit.

William Stahl
PO Box 282
Marlton NJ 08053

I need the operating manual for the Supreme oscilloscope, Model #546A. I will pay any mailing and copying costs.

Glenn Churchill KA2IOI
Box 504
Hudson Falls NY 12839

I am looking for schematics and any other info for the Lafayette He-45 6-meter rig.

Sean Poole KA4LWX
8926 Byron Ave.
Surfside FL 33154

I am looking for the manual and/or schematic for the Hammarlund FM-5 VHF equipment. I will pay for copying and postage.

Bill Ryan WA2DND
CC 140, Rensselaer Polytechnic Institute
Troy NY 12180

Would anyone who has modified a calculator to measure Ohms (April, 1982, *73 Magazine*) please contact me?

Kevin Neal
Rte. A, Box 221A
Flippin AR 72634

Wanted by my friend DJ0QN, near Munich: a repeater offset kit or schematic of same for the Comptronix FM-80 10-meter FM rig. Send price/info to me, please.

Doug Smith WA6GON
1369 Tree Garden Pl.
Concord CA 94518

I need a copy of the Frequency Selection Code Book and Service Manual for the Tennelec Model MS2 memory scanner. I will pay shipping and duplicating costs.

Kenyon B. Courts KA7JJJ
5267-B Mather St.
Eielson AFB AK 99702

Here are some items I am looking for:
- Assembly instructions/operating information for a Tel-Rex Model TC-99C triband beam antenna
- Copies of the operating manuals, shop manuals, and modifications for the Collins 75A4 receiver and a Central Electronics 100-V transmitter
- The current address of Wesley R. Schum, the developer of the 100-V broadbanded exciter-transmitter

I will copy and return immediately with postage refund, or pay for copies.

Bob Robinson KU8C
Route 3 Box 302
Fairmont WV 26554

I need a copy of the service manual for the Bearcat 220. I will be glad to pay copying costs and postage.

Jose Nunez YV2BSV
PO Sox 390
Merida 5101A
Venezuela

I'm looking for the antenna coupler CU-286/FRR-33 part of the radio receiving set AN/FRR-33, and the control monitor C-1012/FRR, keyer KY-82/FRR and loudspeaker LS-179/U parts of the radio receiving set AN/FRR-34.

Roberto Pieraccini
Via V. Veneto 66
51013 Chiesina Uzzanese
Italy

Wanted: Members of school clubs, teachers, and students to participate in education networks to aid technical and non-technical classes. Those interested please send schedule information, or information about existing high school and college networks.

N. S. C. C. Radio Club (K7WWP)
14661 6th Ave. NE
Seattle WA 98155

I am looking for a 40-foot breakover tower manufactured by Tele-Tower in Enid, Oklahoma.

Howard Russell N6EBF
1291 Sandra Court
Upland CA 91786

I am looking for software and the required interface to operate RTTY/CW using the TI-99/4A computer.

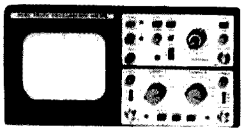
Steve Shaw W6SLY
7740 Larchwood Way
San Diego CA 92120

I need a mobile mounting bracket for the Midland 13-510A 2-meter transceiver.

George Stephens KA3DSA
5813 Bryn Mawr Road
College Park MD 20740

I am looking for information on how to modify the Bearcat 220 scanner so that it will receive on 29.6 MHz and 52.525 MHz.

Marty Linke WD9ABG
621 North Grace St.
Lombard IL 60148

LIMITED SPECIAL $555.00
HAMEG Oscilloscopes
20 MHz
DUAL TRACE
to meet every need

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WILL HEARD BE HEARD?

A DXpedition to Heard Island, in the southern Indian Ocean, nears reality. At the International DX Convention in Visalia, California, last April, Ian Hunt VK5QT announced tentative plans to activate this rare radio location. In the months following, the details (and especially funding) started to fall into place.

Heard Island is a small rock sticking out of the frigid seas not far from Antarctica. To locate Heard on the globe at your neighborhood library, put your finger on Saskatoon, Saskatchewan. Now find the diametrically opposite point on the globe, the spot antipodal to Saskatoon. Unless the manufacturer's logo is covering it up, you should have found Heard. Getting radio equipment and operators to Heard won't be so easy.

Heard sits in the middle of some of the worst weather in the world. Temperatures as low as −60° and winds in excess of 300 km/h have been recorded on the coast of Antarctica, the nearest significant land mass to Heard. Far from shipping lanes and lying in the dreaded wind belt that sweeps around Antarctica, Heard is about as isolated and inhospitable a spot as one can find.

So why are amateurs going there at all? Several mountaineers plan to scale Big Ben, Heard's 2700-meter high, ice-covered volcano. Splitting the costs with the mountaineers in return for providing top-notch radio communications in case of emergency puts the Heard Island DXpedition into the realm of the possible although costs for the radio part of the trip alone will top $30,000.

The International DX Foundation and the Northern California DX Foundation have offered $10,000 each toward the trip, and the Wireless Institute of Australia will provide four stations and has pledged $7,000, which it hopes to raise through donations.

The DXpedition is under the guidance of the DX Chasers Club, a Western Australia group, with Gordon Nichols VK6XI as chairman. Two or three hams will spend the month of February, 1983, on the island, while the mountain climbers do their thing. Since there is absolutely nothing to do on Heard except try to keep warm, the hams should have plenty of time to operate.

The two DX foundations will finance their contributions directly from their treasuries, but they hope to gain new members and receive extra contributions for the effort. The International DX Foundation asks for $25.00 for a one-year sustaining membership (write PO Box 117, Manahawkin NJ 08050). The Northern California DX Foundation (PO Box 2368, Stanford University CA 94305) also will accept Heard funds. But the official Heard Island account is care of the Wireless Institute of Australia, PO Box 10, West Perth 6005, Western Australia.

Incidentally, the International DX Foundation gained quite a bit of notoriety recently with an up-front article in *Time* magazine (May 3, 1982, page 7). Written by Navassa DXpeditioner Ed Magnuson W2IJB, a *Time* staffer, the article brought the world of DXpeditions to 1.6 million readers. The highly successful KP2A/KP1 Navassa trip bodes well for the success of the Heard Island trip. We'll have more on both the Navassa trip and the IDXF in future columns.

Assuming everything stays on track, VK0HI should be on the air early next year. We'll be providing more details on Heard and the DXpedition plans in coming months, but meanwhile, why not send a donation to one of the groups above?

One callsign which will be conspicuously absent from the VK0HI pileup will be that of longtime DXer Jesse Bieberman W3KT.

JESSE BIEBERMAN W3KT

The DX fraternity was greatly saddened to hear of the death of one of its most valued members, Jesse Bieberman W3KT. Jesse passed away on May 28, at the age of 77.

A native and longtime resident of Philadelphia, Jesse displayed an undying dedication to two of his loves: teaching and ham radio. He worked with students both in his job as teacher and in ham radio, founding the school radio club as well as staying active in the prestigious Frankford Radio Club.

In his later years, Jesse served amateur radio as Vice Director of the Atlantic Division of the ARRL for ten years, and then, after 1980, as Director. He attended the IARU conference in Lima, Peru, in 1980 as a member of the Foreign Affairs Committee of the ARRL board, and he served as the board liaison to the DX Advisory Committee.

Jesse's radio career spanned more than six decades, beginning with his first license in 1920. His longtime dedication to DX kept his call on the top of the DXCC Honor Roll on both SSB and Mixed. And when the CW DXCC award was announced, Jesse was ready. He earned CW DXCC Number 1 in 1975, at the age of 70. He also was an active contester, consistently operating for the Frankford Radio Club's winning efforts.

Jesse was best known for his efforts in QSLing. He served as the volunteer manager of the W3 QSL bureau for 33 years, sorting other amateurs' cards and making sure they got to their proper destinations. And in that 33 years, not one amateur officially complained about the bureau, an absolutely remarkable record given the notorious impatience of DXers!

But Jesse did more than handle the incoming cards for hams in the third call area. He shared his years of QSLing experience with any amateur. Jesse ran the W3KT Outgoing QSL Service, the most respected DX QSL forwarding service anywhere. For just a few cents a card, Jesse would locate the best possible QSL route for a given station: direct, through a manager, or whatever. He forwarded your card with others for the same station, with return envelopes. When the cards came back, he distributed them via the incoming QSL service, keeping the costs of the service within the reach of every DXer. Jesse knew all the tricks, all the ways to increase QSL returns.

The W3KT QSL service is now closed. Those cards in the pipeline will be forwarded, but no new cards are being accepted. Jesse's shoes are just too big to fill.

But the DX world has lost more than the best QSL service; it has lost a dedicated DXer who unhesitantly helped others, a fine example to new and experienced operators alike, a man who gave freely of himself so that others could enjoy the hobby that he loved so much. We have lost a good friend. We will miss you, Jesse.

CHINA UPDATE

China continues to make DX news. Both Chinas, in fact. More details of the future of amateur radio in the People's Republic of China leak out around the now-tattered bamboo curtain, and Tim Chen's QSL manager, K2CM, provides some additional details on BV2A/B.

BY1PK has been on and off the air since the first legal operation from mainland China in 30 years began earlier this year. Operator training continues with materials provided by various amateur radio organizations, including the ARRL. The operators will soon return to their homes, carrying with them the experience gained in Beijing. Sometime in the not-too-distant future, these new ops will activate more stations in China, and BYs will be heard more than sporadically.

Meanwhile, bootleggers have been enjoying open season with the BY1PK callsign. The Chinese operators have been deluged with QSLs from well-meaning amateurs who worked someone signing BY1PK. Most of the stateside hams received very nice postcards from China in return for their QSLs and IRCs, but, alas, not a single QSL card. The few hams lucky enough to catch BY1PK on the first run (mostly JAs) can justifiably treasure their colorful cards.

The BY1PK operators stayed on CW, often haunting frequencies 30 kHz up from the bottom of the band, especially on 15 and 20 meters. A straight key and a request for a full QSO with exchange of names and QTHs was typical. QSLs with IRCs to Box 6106, Beijing, People's Republic of China, have gotten a re-

sponse. How soon will BYs be as prevalent as JAs? Not right away, but BY won't be on the top of the most-wanted list for much longer. Meanwhile, there is always the "other" China.

Charlie Moraller K2CM was kind enough to share additional details about Tim Chen and BV2A/B. First, those calls are assigned to the China Radio Association. The club station is quite distant from Tim's home QTH, which limits activity, but Tim continues to be the only member of the Association with permission to operate. The frequent typhoons which rip through the *region* force dismantling of the yagi every year. The normal yagi emits a far better signal than the dipole used in typhoon season.

Charlie says that Tim wants the QSOs from BV2B QSLed direct to Box 101, Taipei, Taiwan, Republic of China. K2CM is the QSL manager for BV2A. Tim's choice. QSL BV2A via K2CM, 70 Silverbrook Road, Shrewsbury NJ 07701.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Sometimes you just can't win. I mean, I try to plan out this column for months ahead, and then you all go and respond to me, and now here I am with a ton of mail on my desk! Oh well, one of the things I most enjoy is answering questions here in the pages of *73*, so I guess this month I'll plunge right in.

Interest in applying microcomputers has never been higher. Dennis Adamkiewicz KA8ETB, from Cleveland Heights, Ohio, drops a line that he is trying to put his home-brew 6803/6847 system up onto RTTY. This sounds like a reasonable combination, and with suitable software should be just the ticket for a silent terminal. The programs published in this column a few years back can provide a starting point for such software, and I am sure that the sequence we are going through now will also be helpful. Let us all know how the project progresses, Dennis.

Chuck Evola is another 6800 buff, but this time with the old Altair 680b. A few months ago, I noted in this column that Chuck was trying to get his system up on RTTY, and the next thing he knew he was exchanging software and printing RTTY using a modified version of the receive program from this column. Chuck sends along his version. I have cleaned it up a tad, and it is printed here for all you 680b fans out there.

Another question posed by Chuck is about a technique to prevent printing unless "true" RTTY is present. I will suggest at this time that such a technique is indeed feasible, using multiple-sampling methods. The receive routine I will develop for the terminal described in July (to continue next time) will use just such a technique, so don't go away.

While we are on the subject of 6800s, Keith Diehl AL7CC up in Anchorage, Alaska, writes of the availability of the A.M.I. 65051/68051 ACIA chip. He notes that this 6800-compatible chip can be interfaced much as the more-common 6850 ACIA, but that it is able to handle five-bit words with a 1½-bit stop pulse. Sounds interesting, Murray or less! Wonder if anyone else is using this chip.

Letters with lists of questions sometimes arrive, and such is the case with a note from Todd A. Lefkowitz, M.D., an opthamologist who enjoys shortwave listening with a special ear towards utilities DXing. Todd's first question is the killer: "Which decoder do you recommend?" I really cannot endorse anyone's RTTY demodulator, Todd, partly because I want to be fair and partly because I have not seen everyone's in use to compare. I can tell you that, in general, you get what you pay for, and that the available low-end demodulators, such as the iRL FSK-500 and Flesher TU-170, provide good performance at an attractive price. Moving up to units such as the iRL FSK-1000 or one of the Hal units may be needed if you need some bells and whistles, but I suggest you write for data sheets from several of these companies and compare specs for yourself.

Two related questions Todd poses are about a source for RTTY frequencies other than Tom Harrington's book reviewed here last year and other sources for Oliver Ferrell's RTTY frequency guide. I am afraid that if Gilfer Associates, the publisher, has indicated to you a lack of copies of the Ferrell book, then you have shot the wad. I know of no other source. The Harrington book, which is available from the *73* Radio Bookshop, remains an excellent (and to my knowledge, the only such) guide to utility and other RTTY signals.

Todd's last question is a common one which I have fielded any number of times. He asks for books or magazine articles on RTTY principles and basics. Unfortunately, there is no book currently available which covers RTTY basics with modern techniques. What is around are ten-

```
                 NAM    680b RECEIVE
                 OPT    NOS,NOG
          * RTTY Receive program for the
          * 680b - 6800 computer
          * Based on program written for
          * RTTY Loop by Marc I. Leavey, M.D.
          * Modified for 680b by Chuck Evola

0020             ORG    $20
0020 00   LTRTBL FCB    $00,$4B,$51,$55,$00,$4A,$57,$41
0028 53          FCB    $53,$46,$59,$53,$42,$44,$5A,$45
0030 56          FCB    $56,$43,$50,$49,$47,$52,$4C,$00
0038 4D          FCB    $4D,$4E,$48,$20,$4F,$00,$54,$00
          *
0040 00   FIGTBL FCB    $00,$28,$31,$37,$00,$27,$32,$2D
0048 2F          FCB    $2F,$21,$36,$07,$3F,$24,$22,$33
0050 3B          FCB    $3B,$3A,$30,$38,$26,$34,$29,$00
0058 2E          FCB    $2E,$2C,$23,$20,$39,$00,$35,$00
          *
0060 00   CRLFST FCB    $00,$0D,$0A,$15,$00,$04
          *
0066      XSTORE RMB    2
          *
0100             ORG    $100
          *
0100 8E 4000  START  LDS    #$4000
0103 86 04           LDA A #$04
0105 B7 F00B         STA A $F00B       : PIA CNTL REG
0108 B6 F00A  SLOOP  LDA A $F00A       : PIA DATA REG
010B 4D              TST A
010C 27 FA           BEQ    SLOOP
010E 8D 4A           BSR    MSEC10
0110 C6 05           LDA B #$5
0112 4F              CLR A
0113 48       CLOOP  ASL A
0114 8D 41           BSR    MSEC20
0116 BA F00A         ORA A $F00A
0119 5A              DEC B
011A 5D              TST B
011B 26 F6           BNE    CLOOP
011D 81 1D           CMP A #$1D
011F 27 2E           BEQ    CRLF
0121 81 04           CMP A #$04
0123 27 0F           BEQ    FIGS
0125 81 00           CMP A #$00
0127 27 04           BEQ    LTRS
0129 81 1B           CMP A #$1B
012B 26 10           BNE    GETCHR
012D CE 0020  LTRS   LDX    #LTRTBL
0130 DF 66           STX    XSTORE
0132 20 09           BRA    GETCHR
0134 CE 0040  FIGS   LDX    #FIGTBL
0137 DF 66           STX    XSTORE
0139 8D 1F           BSR    MSEC10
013B 20 CB           BRA    SLOOP
013D B7 0143  GETCHR STA A LOCATE+1
0140 DE 66           LDX    XSTORE
0142 A6 00    LOCATE LDA A X
0144 BD FEB3         JSR    $FEB3      : CHAR OUT TO TERM
0147 CE 0200         LDX    #$0200
014A 09       LOOPA  DEX
014B 26 FD           BNE    LOOPA
014D 20 B9           BRA    SLOOP
              *
014F CE 0060  CRLF   LDX    #CRLFST
0152 BD FEC1         JSR    $FEC1      : PDATA
0155 20 B1           BRA    SLOOP
              *
0157 8D 01    MSEC20 BSR    MSEC10
0159 01              NOP
015A CE 0232  MSEC10 LDX    #$232      : 75 WPM
015D 09       DLOOP  DEX
015E 26 FD           BNE    DLOOP
0160 39              RTS
              *
                     END
```

Program listing.

and twenty-year-old circuits and books which predate ASCII and much other recent development. Hopefully, this is a situation which will be soon corrected by the gang at *73*. As far as magazine articles, you are reading the most consistent source for RTTY information for the last five years. Within the covers of this magazine, I am sure you will be able to find the answer to many, if not all, of your RTTY problems. If you have specific questions, drop me a line and I will see what I can do to reply in a future column.

Carl E. Nelson KI0H, in Blaine, Minnesota, touches base with his recently-developed interest in RTTY. He wants to put an ASR-33 Teletype® machine on the air and is looking for plans for an AFSK generator and demodulator. He also is interested in ASCII-to-Murray (Baudot) conversion, for use on five-level circuits.

A similar question comes from Dr. William W. Fulcher, Jr., N4WF, over in Hendersonville, Tennessee. Bill is looking for help in wiring a Teletype Model ASR-28 he has obtained for amateur use.

Well, gentlemen, and ladies in attendance also, many of these questions have been answered in previous editions of "RTTY Loop." In the five years of this column, I have covered the hookup of many types of Teletype machines and have presented various circuits for transmitting and receiving. At present, there is no compilation of this material available. Hopefully, something of this kind will be available in the not-too-distant future. If you are interested, drop me a line and let me know what you would like to see in such a publication.

A gentleman who makes his wants clearly known is Larry Marcus W5MDT, from Piano, Texas. Larry is looking for a book or source that will give a "comprehensive understanding of the various computer software available as well as the dedicated machines" that he sees advertised. The biggest problem with this, Larry, is the huge variety of stuff. It would be difficult to assemble a collection of all that is out there in one place to "A/B" compare it, and short of such a direct comparison, any presentation is bound to be biased. Nevertheless, I would refer you to the many articles presented here in *73* and in our sister publication, ***Microcomputing***, for some help. I have tried to review whatever I have been able to get ahold of, and in the past have looked at several systems. Many manufacturers, however, are less than willing to submit their systems for criticism. Again, I am sorry, but to the best of my knowledge, no book is available that would answer your need specifically.

Speaking of manufacturers, I have a note here from Bob Pearson KH6AKW, who runs an outfit called Hawaiian Computer Software. Bob has a program for the Ohio Scientific Superboard II that enables that computer to run Murray and ASCII with a variety of features and enhancements. It looks interesting, although I am unable to try it out, for lack of a Superboard II! A random thought which occurs to me is that the Superboard II is a 6502-based computer, much as the Apple and Pet. Wonder if some conversion would be possible to these systems? Might be worth looking into, Bob. Anyway, if you are interested, drop Bob a line at Hawaiian Computer Software, 99-060 Lohea Place, Alea HI 96701. Make sure you mention ***73 Magazine's*** "RTTY Loop" in your note, OK?

More next month, with a return to the super 6800 RTTY terminal we have been describing. Remember, if you want a question answered here in the column, send it to me at the above address. If you would like a personal reply, you must enclose a self-addressed stamped envelope. I try to answer all questions received, but I do have quite a backlog. Just be patient, and keep watching "RTTY Loop."

REVIEW

THE INFO-TECH M500ASR

This is not really meant to be a "product review" but a down-to-earth look at some of the excitement and problems a new product can bring and the way it affects the health and well-being of the owner of a new piece of gear—especially if it is of new design.

The Info-Tech M500ASR is a state-of-the-art communications terminal for use in the transmission and reception of RTTY in the ASCII and Murray (Baudot) codes as well as for sending and receiving Morse code. It is a microprocessor-controlled unit based on the Fairchild F8 (3850) and has 20K of memory which is divided up into 8K ROM, 8K RAM, and 4K video RAM. There is an option that allows the addition of 10K of RAM for the mailbox systems.

The system consists of three major units: the mainframe, which houses 95% of the electronics, the keyboard, which is connected to the mainframe via an umbilical cord, and the monitor, which is a Sanyo VM4512, 12-inch black and white monitor.

Features

The M500ASR will encode and decode ASCII up to 1200 baud and Baudot up to 100 baud. In the ASCII mode at 110 baud, it uses an eleven-unit code which consists of 1 start bit, 7 data bits, 1 parity bit, and 2 stop bits. When using 150 to 1200 baud ASCII, the M500ASR uses the ten-unit code which is the same as the eleven-unit code except there is only 1 stop bit. The use of parity is also keyboard-selectable from odd, even, or none. When none is selected, parity is marking. In the Baudot mode, the M500ASR uses the standard 7.5-unit code. In the Morse mode, it will send and receive CW from 5 to 100 wpm, with auto-tracking on receive.

There are five types of transmitting modes in RTTY: letter mode, word mode, line mode, buffer mode, and clocked mode. In the letter mode (or character

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mode, as it is more accurately described), each letter is transmitted as it is entered from the keyboard. In the word mode, the pre-typed word is sent only after the space bar is entered. In the line mode, an entire line of text is transmitted only after the return key is depressed. In the buffer mode, pre-loaded buffers are dumped on command.

Of all the different modes that are available, the clocked mode is the most unique. The output is slowed to a speed that depends upon the setting of the clock output value. It allows the transmitted character output to maintain a constant rhythm that gives the station on the receiving end the illusion that you are typing at a smooth and even rate. In selecting clock values, a selected value of 1 would be full speed and 9 would cause the output to be one ninth the normal rate.

The M500ASR has several different message systems available. There are ten programmable messages of up to 144 characters each. Each message can be sent separately or the entire contents of messages 0 through 9 may be linked to allow up to 1440 characters to be preloaded. This is especially handy for "brag tapes" or message handling. There are two types of ID messages available. One is CW ID only and the other allows a RTTY message to be incorporated into the ID. This message is preprogrammable and allows you to ID in RTTY then CW. After CW ID, it will go back to the original mode and speed automatically.

The Modem

The modulator/demodulator system (modem) of the M500ASR uses an envelope detector tuned to a center frequency of 1000 Hz for the detection of Morse code. However, as with any other system that receives Morse code, it must receive decent CW. If you try to copy someone who uses his own brand of spacing (the type that makes Sam Morse roll over in his grave), you will get nothing but garbage on the screen. However, if the transmitting station is using an electronic keyer with proper weighting or, better yet, another computer, you will get 100 percent copy (depending on band conditions and QRM, of course).

In the RTTY mode, a three-shift active filter demodulator is used for all Baudot speeds and 110-baud ASCII. The shifts are 170, 425 and 850 Hz. The 425-Hz shift is really handy for those serious SWLs who love to see the news before anyone else does, or get the latest in the weather directly from the National Weather Service in Kansas City. A separate active filter is provided for ASCII speeds from 150 to 1200 baud. The RTTY tones are provided in several different ways. There is a three-function generator used to generate the audio tones that are fed directly into the mike of your rig. In addition to AFSK, there are FSK, inverted FSK, and RS-232 keying outputs.

For automatic operation of the keying circuit of your rig, there are several different push-to-talk (PTT) lines available. Now, while we are on the subject of AFSK and FSK, some of you old-timers will be saying, "He should tell new operators to use FSK only, because AFSK causes adjacent channel splatter and unnecessary QRM." Well, let me say this: I have been using nothing but AFSK for over a year and have not run into any problems yet. The catch is that you must be very careful not to overdrive your rig and must check your outgoing signal regularly for flat-topping and distortion. Should you find the AFSK generator is flat-topping, splattering, or distorting, the level can be lowered from the factory-set value of 1.5 volts.

Hard Copy

If you decide to become a "green key," at some time you will find the need to have a hard copy of what you have received. (If for nothing else, just to show your friends the pictures of the nudes being sent on 14.0895 MHz.) This is one area where the M500ASR really shines. There are several different printer inputs and outputs available, including a fully-isolated loop for those of you who still insist on using a mechanical monster such as a model 15. For the newer printers, RS-232 and MIL-188 are available. But that's not all. The printer outputs are fully regenerated. You can copy 110-baud ASCII on your 45-baud model 19 or 1200-baud ASCII on your Epson set at 300 baud without the need for external converters.

There is a limit to this. If you try to copy 1200-baud ASCII and print it on a printer set at 300 baud, the printer buffer on the M500ASR will fill up, overwriting text that was already in the buffer. Also, let me remind those of you who are into SWLing that what you copy is for your eyes only. Don't make the mistake of printing out a long story from the AP or UPI and showing it to your neighbor. If you do you will be violating FCC regulations.

Tape Interface

RTTYers tend to be very long-winded. This is where a cassette interface becomes very handy. Most RTTYers have compiled brag tapes that give a rundown of their station equipment. Some include personal information, general info about the XYL, the rug rats, dog, cat, job, etc. Most of the cassette interfaces in use today are really nothing more than a few simple connections which allow you to record and play back through your terminal.

The M500ASR cassette interface is more like the type of interface you would find on a personal computer. It actually outputs data in blocks using Kansas City standard tones. The data is loaded and stored in fixed blocks of 1008 characters. Each data block is preceded by two groups of synchronizing leaders and followed by a group of end-of-block transfer codes. The codes are automatically generated when a recording is made, and tested when it is played back. When the cassette load or dump command is entered, the cassette motor control will turn on, starting the cassette recorder. Then the first synchronization group will be sent. After the recorder comes up to full speed, the second group will be sent followed by the data block and end-of-block group. After the end-of-block group is sent, the cassette motor control will turn off.

Because of the way the tape is formatted, it is not necessary to start the tape at a specific point when playing back or loading data. Also, all other functions may continue in normal operation as long as you do not try to access the buffer where the tape operation is originated.

In actual operation, I have found that the tape interface is a handy device, but it is not too well suited for use in running brag tapes or picture tapes due to the limit of the buffer. What it will allow you to do is to make a tape of your general operating parameters. Then all you have to do is turn the power on and enter the cassette-load command. While the cassette interface is loading your CQ message, ID, CW ID, Sel-Cal codes, and WRU answer codes, you can drink a cup of coffee while the machine does all the work.

Screen Options and Mailbox

The M500ASR has a "split screen" which divides the transmitted text and received text, both of which are displayed at the same time. The upper portion of the screen is the received text and is brighter in intensity than the lower, which shows the transmitted text or the text entered into the transmit buffer.

The system uses a 25-line by 72-character format of which any number of lines from 2 to 15 can be assigned to the transmit buffer. The bottom (25th) line is reserved for the status line which shows the current operating parameters of the unit and the time and date in local or Zulu time.

The receive video has word wraparound, a feature which prevents the unit from cutting off a word of 15 characters or less at the end of a line. When operating in the word or line mode, the transmit video area has the same feature. The system uses dual cursors. One, known as the keyboard cursor, indicates where on the screen the next character entered from the keyboard will be placed. The other cursor, called the transmit cursor, shows what character is next on line to be transmitted. This allows you to see how far ahead of the output you are when typing into the buffer and serves as an indicator of the number of characters which remain to be transmitted.

There are several keys available to the operator of the M500ASR. Along with the CQ and DE keys, there is a break key which, when depressed, causes the RTTY outputs to remain in the mark condition. When operating in the Morse mode, it causes the transmitter to be turned on. There is a run/load key which

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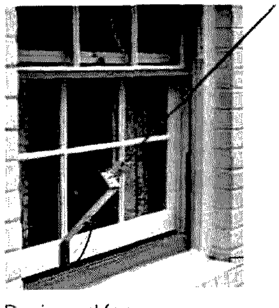

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controls the transmit buffer output condition. There is a repeat key which, when held down in conjunction with any other key, will cause that character to be repeated until one of the keys is released. The blank key causes the keyboard cursor to move back one space for each time it is depressed, up to the beginning of the line. There is a reset key which clears all of the RAM and initializes the operating parameters and causes a self test of the various segments of RAM. For Morse operation, there are special keys for AR, AS, BK, BT, SK, "Attention," and "Understand."

What do I do if I make a mistake when I am loading a message into the transmit buffer? Well, with the M500ASR's powerful editor, all you do is enter a few simple commands and, at the stroke of a key, you can delete a character, insert a character, or insert a string of characters. To edit text that has scrolled off the transmit video screen, you must enter the receive area buffer editor mode. Then you can edit the text in the same manner as you would when in the transmit buffer editor. The operation may sound complicated but it is not. The dual editor is a very powerful and extremely useful device. I have typed out several letters, and I even wrote this article using the M500ASR as a word processor.

I mentioned a mailbox option that is available for the M500ASR. I operated the system with the mailbox option, and, to be completely honest, I would not call it a mailbox. Generally, you think of a mailbox as being an electronic depository for the operator to receive messages while he is away from the shack. In reality, the M500ASR mailbox allows only others to send and receive messages. It gives stations total and complete control of the system. They can list a directory of messages in the mailbox. A station can call up a selective directory that lists only those messages that are for him. He then can read those messages and erase them. It really works well for other stations but it serves no purpose for the owner of the system.

The owner of the system cannot read a message or write a message for someone else. In fact, he cannot use it at all, because when in the mailbox mode, the keyboard is completely locked out. The only way to remove the system from mailbox operation once you are in that mode is to press the reset key or turn the power off. It is, in effect, a "blind mailbox." This would be a nice option for a RTTY repeater.

Problems

Murphy's law states that what can go wrong will go wrong, and believe me, for a while I thought I was Murph's stepson. When I traded my M200F and M300C for this brand new top-of-the-line system, I was, to say the least, very excited. I never had one bit of trouble with the other system, but when I hooked up the new system things started changing rapidly. During the first day of operation, the system showed some very strange and erratic behavior, bordering on being schizo. I had a choice. Either I was becoming senile (at age 28) or the microprocessor had a mind of its own.

The mark tuning LED went first. Then the system started refusing commands from the keyboard. Steadfastly, it ignored everything, while the colon on the block winked merrily away. A phone call to Info-Tech confirmed my suspicions: They were having problems with the programming of the ROMs and knew how to fix it. So, back to the factory it went. (Let me point out that I got the fourth production unit off the line and was really not too concerned with the problem. We all know that when something is new it is subject to several attacks of Murphy's law.)

Ten days later, the dust was barely settling in the tracks of the UPS truck when I had the system back on line. What happened now? Nothing happened. Murphy struck again. Now I am starting to have some second thoughts. Oh well, a phone call produced some reassuring sounds on the other end, and it was back on the road again for my M500ASR.

Like clockwork, ten days after I returned the unit the second time, T.J., the UPS lady, returned with my M500ASR. This time she did not even get a chance to get out the door before I had the unit hooked up and the power on.

Did it work? Well, it worked for a while, anyway. The mark tuning LED was fixed and everything seemed to be okay for about 15 minutes. And then? Data started jumping around to weird places. The entire screen filled with characters and started an endless scroll to oblivion. Bits and pieces from the recallable messages were popping onto the screen out of nowhere. Every time I tried to operate in the load mode, the system would try to send the status line over and over again.

I would hate to be on the receiving end of the phone call that would result from a problem like this. Luckily, John, at Info-Tech, had some more very interesting sounds to make. I think he could have been a politician.

A Short Time Later...

Someone is knocking on my door. Oh! "Hello T.J., I see you have a package for me. Great! It's my brand new (rebuilt) M500ASR. Thanks, T.J., see you later." As she shut the door behind her, I made a mad dash for the bench and started hooking up the unit. Let's see now. Power on. Looks good so far. Monitor on. All systems go. Status line normal. I want to assign four extra buffers to the transmit buffer, so I depress the SHIFT and CTRL keys at the same time and enter XB-4*. Yep, it works. I start tuning around the band, signals everywhere. Let's see, there's a strong one. It's 6D5M, with a nice signal in here calling CQ. I answer him, and we have a nice chat. Well, everything seems to be working OK. Maybe it's fixed.

Did you ever feel like you were Charlie Brown trying to fly a kite? You know, when the kite-eating tree always devours his pride and joy. Well, you can't blame the tree, it's probably hungry. Gremlins are like that, hungry all the time. They need three squares a day of silicon.

The same problems were there and I was getting a little tired of sending this system back to the factory. I saw a trend developing. After a long discussion with John, he said that he would send me a new set of EPROMs with some of the revisions to the program on them.

Even Later...

Someone is knocking on my door. "Hello, T.J., how are you doing? I see you have a package for me. Thanks, T.J., see you later."

Ten minutes later everything is hooked up and ready to go. What's that noise? I still hear little grumbling sounds. Must be my imagination. Power on. Everything looks good. Status line normal. Add four buffers to the transmit buffer. All systems go. I start tuning around the band. Wow! A 25 over signal. Its HH2CL with a great signal in here. Solid copy. Well, how about that, everything seems to be working fine. That makes the final score Info-Tech 1, gremlins 3. Not bad for a new player on the team.

One week later the battle cry of gremlins is loud and clear. They lost the battle, but the war is not over. They attack from all directions. The treaty is broken. Charlie Brown has better luck than this. Okay now, count to 10, stay cool, be calm, don't get excited. I am sure there is a logical explanation for this.

After some lengthy discussion with John, he decides to send me a new set of 2716 EPROMs and a new set of RAMs, on the thought that one or more of the RAMs could be bad. Well, at least it is not so bad this time. I can still operate RTTY while I am waiting for the new parts. The system acts only a little screwy.

Five days later T.J. is back at the door. After I scribble my name on the necessary form, not even the Roadrunner could catch me as I smoke the trail between the door and the bench.

It took longer this time, but two weeks later the gremlins were at it again. This time I think they are in for the duration. They are doing things I have never seen before. They are even attacking the keyboard, making some of the keys operate funny. I think this unit is jinxed.

Back on the phone with John. (I think I will put in a WATS line.) We discuss the problems and come to the conclusion that it would be best to send me a brand new system.

Three days after I shipped the unit back to Info-Tech, I called John to follow up and see that the unit had arrived. Indeed it had, but it did not make the trip in too good a shape. It seems as if UPS bounced it around a little and reduced it to a metal and silicon junk heap. Don't worry, I had it insured. John informed

me that they had already shipped me a new system and he would take care of the insurance claim from that end.

Murphy Lives!

Nothing is ever as simple as it sounds. Three days later, T.J. left a package for me on the door step. Imagine my dismay when I saw a yellow damage tag on the package. I thought they had damaged my new unit. Upon opening the package, I found it was the old one. Old Serial Number Four! Pieces of M500 were stuffed in the box. Great! What now? Out to the shack to call John and find out what is going on.

When I told John what had happened, the silence on the other end was deafening. His first words were "Oh, boy!" Then, after we discussed what had happened, he told me he would call me back and let me know what to do with the old one. In the meantime, my new system should be there the next day.

Here comes T.J. up the drive, and about thirty minutes later I had the new system (Serial Number 25) up and running. Everything was doing what it was supposed to do, and doing it well. And now that I had operated a fully-functional system, I realized that it was worth the time and trouble. Info-Tech has made a great advancement in the state of the art of RTTY.

John tells me that they want to put the old unit to the torture test and see if they can run the resident gremlins off. I wish them all the luck in the world. But right now I have to get dressed as T.J. and I are going to dinner and a show to celebrate.

The M500ASR (with 12" monitor) has a list price of $1475. A memory-expansion board with mailbox option costs $180. For more information, contact the manufacturer of Info-Tech equipment: *Digital Electronic Systems, Inc., 1633 Wisteria Court, Englewood FL 33533.* Reader Service number 482.

Jim Brown N4DDS
Eads TN

THE MFJ CW COMPUTER INTERFACE

MFJ Enterprises has done it again. For about $70.00, you can obtain a compact (6" × 4" × 2") yet complete interface for receiving and sending Morse code with your computer. Of course, you must write the software. But at least the hardware problem is largely solved.

In this review I will discuss the various aspects of the MFJ-1200 with emphasis on its design, features, and limitations. I will also explain why an interface is needed. Finally, I shall supply you with a BASIC program to receive Morse code. In this way, you can try out your 1200 right away while you are developing more sophisticated software to suit your own application. And, if you are a Heath H-8 and H-89 computer owner and cannot wait to get on the air with your machine, write me. I have a good program at a reasonable price available separately or in a package with the 1200.

First of all, what do you need to use the computer to read Morse code? Essentially, you must solve two problems: the hardware interface and the software support. First, let's look at the hardware. Imagine if you can the audio output of a radio receiver tuned to a CW signal. If you view it on an oscilloscope, you will see a train of audio oscillations of various widths interwoven with periods of no output. Each packet of audio waves represents an audible tone and its width determines whether it is a dot or a dash. The times when there is no output are the intracharacter, intercharacter, or interword spaces.

You can draw a curve around each wave packet. This curve is constructed to be tangent at each local maximum (peak) of the audio oscillation and is called an envelope. Ideally, the envelope is a rectangular wave, but in practice it will have finite rise and decay times. Of course, what I am describing is nothing more than an audio signal modulated by a rectangularly-shaped wave of a much longer period. Typically, the audio tone has a frequency of 1000 Hz or a period of 1 millisecond. At 20 words per minute, the envelope is about 180 milliseconds in length for a dash and one third of that for a dot.

The computer wants only the envelope, or, rather, its upper or lower half. The audio is only a carrier, and the situation is completely analogous to AM modulation and detection. Thus, the CW detector must extract the envelope, shape and enhance it, and then present it to the computer at a compatible level. This is precisely what half of the MFJ interface accomplishes. The computer will see a series of logical highs and lows at its input, where the length of time between transitions represents a dot, dash, or space. It is now up to the computer to convert the digital information to readable text.

Take a look at the schematic design of the MFJ-1200, Fig. 1. Beginning at the audio input jack, we find a simple diode noise clipper followed by a two-stage, multiple feedback, bandpass filter. The calculated center frequency is 850 Hz and the 3-dB bandwidth is 175 Hz for each stage. The second stage also drives an LED indicator which blinks with the CW input and provides an indication of proper tuning. Following this is a simple diode detector with a sense switch, and this circuit precedes a second-order, VCVS low-pass filter with unity gain and a calculated cutoff frequency of 75 Hz. This additional filter takes out unneeded detection products. Next, a comparator circuit shapes the detected output to produce a rectangular wave with a fast rise time and to generate RS-232 levels. Finally, a transistor converts the RS-232 to TTL levels.

Using a function generator and an oscilloscope, I found the center frequency to be 860 Hz and the 3-dB bandwidth to fall in the 780-to-950-Hz range. My frequency meter does not allow resolution finer than 10 Hz, so these values are certainly in agreement. I also measured the

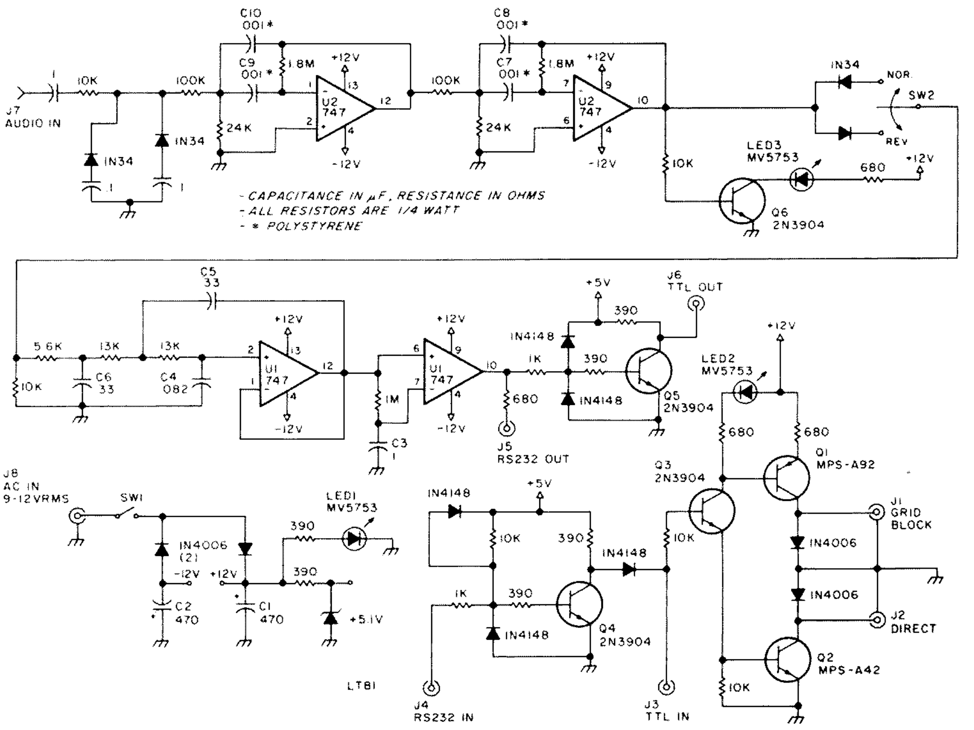
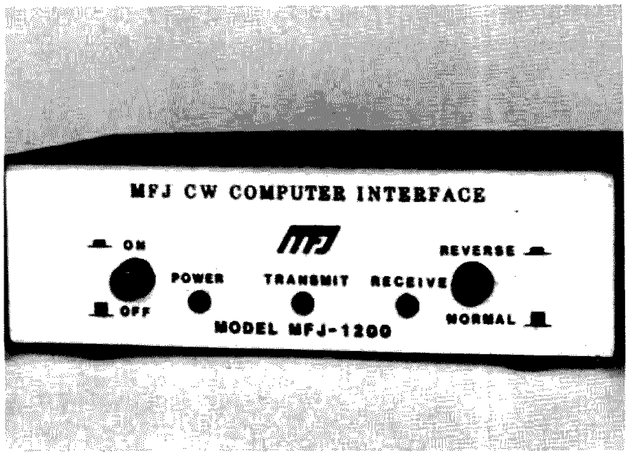


Fig.1. Schematic diagram.



The MFJ CW computer interface.

low-frequency filter cutoff and read a 3-dB point of about 60 Hz. And, finally, I checked the rise time of the TTL output with an input code signal of about 22 words per minute and found it too short to measure.

The detector circuit is quite simple—a diode and a low-pass filter. It differs from the more frequently used 567 tone decoder. MFJ told me that they had experimented with the decoder but finally decided on the circuit described. It does, however, have a slight disadvantage, and that is that the bandwidth is rather strongly dependent on amplitude. I found that the higher the input amplitude, the wider the range of response. In contrast, a 567 will respond only over a width of about 14% of its free-running frequency once the input magnitude exceeds a certain threshold. But I have experienced no difficulty in actually using the 1200, and the documentation cautions the user to reduce the input until only the desired CW signal is activating the received-signal LED.

The MFJ-1200 will also key a transmitter. A transistor converts RS-232 to TTL levels, and a second transistor drives two high-voltage keying circuits. Unfortunately, the documentation does not give the maximum allowed ranges, but the catalog lists −300 volts at 10 mA and +300 volts at 100 mA. An LED glows when the transmitter is keyed. I have also used the unit to activate a battery-operated code-practice oscillator when running my AUTOSEND program. This program produces random or fixed-length code groups for learning Morse, and the 1200 not only allows me to hear the output but also to make practice tape recordings.

Let us now look at the MFJ-1200 from the user's standpoint. There are two switches on the front panel. One applies power. (The rectifier and filter circuits are inside; the power transformer is external and is built into the wall plug. Thus the unit expects 9-12 volts ac, and the application of dc can damage it.) The other push-button is a sense or normal/reverse switch. The output logic is reversed if this is pushed in. The usual convention is for a logic 1 to be an electrical low. However, with this switch the opposite sense can be chosen.

In addition to being able to accommodate various hardware/software arrangements, the sense switch has a rather unusual application. Some CW utility stations occasionally use frequency-shift keying. The various Navy stations on 8.090 and 12.135 MHz transmit with an 850-Hz shift from time to time. To take maximum advantage of CW FSK, you should have a RTTY modem such as the iRL FSK-1000. However, with the MFJ-1200 you can read either the mark frequency or the space frequency by changing the sense.

On the back are seven phono sockets and the ac-power connector. It is best to attach the audio input in parallel with the speaker line because the receiver volume control can be used to regulate the input level. This is important for readable code.

Two sockets give the detected output to the user at either TTL or RS-232 levels. These are the inputs to the computer. However, you cannot really use a serial input port even though the output from the 1200 is itself serial data. This is because Morse output does not have the form expected by the computer interface (UART) of start bit, data bits, parity bit, and stop bit(s). Rather, the software itself must perform as the UART. What the computer really needs is a one-line parallel port.

Many computers have parallel ports which usually operate at TTL levels, and it is quite easy to read them using assembly or high-level-language programs. Some computers have no parallel ports which are provided by the manufacturer. A good example is the Heath H-89, but even in this case it is easy to find input and output lines which are not part of the serial signal-in and signal-out paths. Many UARTS, such as the INS8250 and the 8251, provide several lines to control modems or other peripheral devices. For example, the 8250 has eight—four each for input and output. The output lines are located at port address +4 and are called Modem Control Lines. Similarly, the modem status lines at port +6 can be used for input. The 8251, while not quite so versatile, has one input and two output lines which can be found at port address +1. In some cases, the modem lines can even be used to generate interrupts. For more information, see your computer documentation.

The next two connectors on the MFJ-1200 are TTL or RS-232 inputs from the computer. The same remarks about output lines apply, and attachments should be made from a parallel port or modem control line and not from a signal-serial-output port. Finally, two sockets, one for direct and one for grid block keying, are provided. A subminiature phone jack is used for 12 volts ac.

To use the 1200, a CW signal is tuned until the received signal LED blinks brightly. The amplitude of the signal is then reduced until only the signal itself turns on the light. Too much drive causes the unit to interpret noise and adjacent channel interference as valid signals. The resulting output to the terminal is rubbish, with the periods between transmissions filled with Es and Ts. I found that with relatively careful tuning and regulation of volume, the received code was printed very accurately.

One of the most difficult aspects of using the unit is getting the volume level set properly to avoid false triggers and setting the center frequency accurately. The two go together since the detector allows a wider bandwidth with high amplitude. It would be a great help to have a tuning meter. One must balance economy with performance, of course, but it would be really useful to at least have a socket on the back where a simple meter could be connected. I found that after an initial setting, I could improve the accuracy by reducing the volume until the LED became quite dim and then returning for maximum brightness. Things do not have to be absolutely perfect; there is enough tolerance for minor errors, and the technique just described is adequate.

How well does it work? To find out, I tried it with several Morse programs and made a few heuristic comparisons. I also made a qualitative comparison with another CW detector—the iRL FSK-1000. Before you say that iRL makes only RTTY demodulators, let me remark that the FSK-1000 is an outstanding unit for CW, although for some reason the company never mentions this explicitly. Excellent filters, AM and limiter-detection modes, narrow bandwidth, and many other features make it a versatile unit for digital communications. I also point out that it costs eight times as much as the MFJ-1200, and its purchase for CW use alone is not sensible.

In all cases, we obtained good accuracy on machine-sent CW from the various utility stations. It seemed that a few more errors were made with the 1200 than with the FSK-1000, but the difference was not great. Amateur reception was not as good, but this has little to do with the characteristics of the CW interface or the program but rather with the nature of amateur communications itself. At this point, we should perhaps mention that computer CW may initially be a disappointment to some. Even very good Morse programs do not tolerate bad sending, and unfortunately it can be found everywhere. It takes an astute combination of eye, ear, and experience to use the computer in such code since a high percent-

CW SOFTWARE

The purchase of the MFJ-1200 solves a vexing hardware problem, but you still must write or purchase a program to fit your needs. You can test your new 1200 with a simple but effective BASIC program which I have shamelessly lifted from an article in *Kilobaud Microcomputing* by Robert W. Kurtz W8PRO (see References). Originally written for the Kim computer, I have tightened and modularized the code but left the basic technique intact. The original look-up table also has been modified by adding all Morse characters, and I have replaced the author's use of a "-" for a missing character by a null string. Finally, I have not hesitated to use the various features of MICROSOFT® BASIC such as integer representation and double-letter-variable names. However, the original variable names used by the author have not been altered. (For a detailed description of the theory of operation, see the original article. We will supply a copy for an SASE. If you are running HDOS, send us a disk and we will return a copy of the program as well.)

When you adapt the listing for your system, you may leave out the REM statements as well as those lines and comments preceded by an apostrophe. You can replace double-letter names by other variables. You also can omit line 240 if you do not have integer specifications, and you can omit the error-handling subroutine at 250. It is used to keep integer overflow from stopping the program. This will occur if the integer variables DO and DA are constantly incremented by noise without a chance to reset. It is not serious and it will never happen when receiving normal code.

The error routine also reminds you to set the input port parameters when you first run the program. Let us tell you how we connected the MFJ-1200 to our computer and this will explain the settings we used at line 790: 790 DATA &076, &040.

On a Heath H-8, there are several serial and parallel ports. Four of these are controlled by an 8250 UART. We attached the RS-232 output of the 1200 to the Data Set Ready (DSR) modem status line at a port addressed at 070 octal. DSR can be read by detecting the fifth bit at port address +6. Hence the input to the port must be ANDED with 00100000B (040 octal) to be read. This explains the values in the BASIC line above. The ampersand is MBASIC'S way of designating an octal constant. Equivalent decimal integers can also be used.

The program expects a value of A = 0 when the key is down. You will have to modify the program if the port read subroutine returns a different value for the same condition. Alternatively, you might be able to use the sense switch on the 1200 if the logic is simply being inverted.

If you have an H-89, use the port at 330 octal (0E8H). Attach the 1200's RS-232 output to pin 6 on the D-connector and ground to pin 7. (This is standard RS-232 protocol.) It is not necessary to attach anything inside the computer. For other machines, please consult your documentation. If you have a TRS-80, MFJ has a special version of the MFJ-1200 for you.

If you want to experiment with a sending program, you can try to use BASIC, but it will not be very satisfactory unless you can use character instead of line input. In Morse code it is better to send out a character as soon as it is entered on the keyboard. Microsoft's INPUT$ offers such a method. See also Reference 2.

```
100 REM          ****** MORSE CODE READER ******
110 '
120 REM WRITTEN FOR KIM BASIC BY:        ROBERT L. KURTZ, W6PRO
130 REM                                  4 SANTA BELLA ROAD
140 REM                                  ROLLING HILLS, CA 90274
150 REM
160 REM MODIFIED FOR MICROSOFT BY:       WILLIAM S. HALL
170 REM                                  MLM ASSOCIATES
180 REM                                  5621 MAPLE HEIGHTS COURT
190 REM                                  PITTSBURGH, PA 15232
200 REM                                  412-683-4742
210 REM 1 JANUARY, 1982
220 '
230      REM:  INITIALIZE EVERYTHING
240 DEFINT A-B: DEFINT D-N               'USE INTEGERS FOR SPEED
250 ON ERROR GOTO 980
260 GOSUB 630                            'LOAD MORSE CODE CHARACTERS INTO ARRAY
270 '
280      REM:  MAIN PROGRAM LOOP
290 GOSUB 830:IF A<>0 THEN 290           'READ PORT AND LOOP FOR KEY DOWN
300 B=0                                  'KEY IS DOWN.  SET COUNTER TO ZERO
310 GOSUB 830                            'LOOK AGAIN AND INCREMENT COUNTER
320 IF A = 0 THEN 360 ELSE GOSUB 880     'WAIT FOR DASH TO FINISH
330                                      'ELSE PROCESS DOT
340 C=((5*C)+(2*B))/6                    'UPDATE TIMING CONSTANT
350 GOTO 400                             'BYPASS DASH PROCESSOR
360 IF B < .5*C THEN 310 ELSE GOSUB 930  'IF B TOO SMALL STAY IN LOOP
370                                      'ELSE PROCESS DASH
380 GOSUB 930: IF A=0 THEN 380           'WAIT FOR KEY UP.  KEEP COUNTING
390 C=((4*C)+B)/5                        'UPDATE SPEED CALCULATIONS
400 B=0                                  'RESET COUNTER
410 GOSUB 830                            'NOW MEASURE SPACE LENGTH
420 IF A=0 THEN 300                      'KEY IS DOWN AGAIN.  GO BACK
430 IF B < .5*C THEN 410 ELSE GOSUB 540  'SEE WHAT KIND OF SPACE WE HAVE
440                                      'IF LONG ENOUGH CHARACTER IS FORMED
450 GOSUB 830                            'KEY DOWN YET?
460 IF A = 0 THEN 300                    'YES, SO START NEXT CHARACTER
470 IF B < 2*C THEN 450 ELSE PRINT " ";  'NO, PRINT SPACE IF UP LONG ENOUGH
480 K=K+1:IF K < 72 THEN 290 ELSE PRINT  'UPDATE LINECOUNT AND PRINT NEW LINE
490                                      'IF NEEDED
500 K=0:GOTO290                          'RESET LINE COUNT.  START AGAIN
510 '
520      REM:    CONVERT AND PRINT CHARACTER SUBROUTINE.  SEE ORIGINAL
530      REM     ARTICLE FOR EXPLANATION OF CODE CONVERSION METHOD
540 DA = DA*2
550 D=DA+DO
560 IF D > 361 THEN D=100                'INVALID CHARACTER.  PRINT NULL
570 PRINTA$(D);
580 DA=0:DO=0                            'RESET VALUES FOR NEXT CHARACTER
590 K=K+1                                'BUMP LINECOUNT
600 RETURN
610 '
620      REM:    SUBROUTINE TO LOAD MODIFIED BRYANT CODE AND PORT DATA
630 DIM A$(361)
640 FOR N=1 TO 119:READ A$(N):NEXT N     'LOAD MOST MORSE CHARACTERS
650 DATA E,T,I,A,N,M,S,U,R,W,D,K,G,O,H,V,F,U`,L,A`,P,J,B,X,C
660 DATA Y,Z,Q,O`,CH,5,4,<SN>,3,E`,,,2,<AS>,<AU>,<AR>,,,A~,,1,6
670 DATA <BT>,/,,,<NK>,,,7,,,N`,8,,9,0,,,,,<SK>,,,,,,,?
680 DATA -,,,,,-,,,.,,,,,,,,,,,',,,-,,,,,,,,,,;,,,(,,,,,,,-,,,,,:
690 A$(76)=CHR$(95)                      'LOAD SOME SPECIAL CHARACTERS
700 A$(81)=CHR$(34)                      'DIFFICULT TO DISPLAY DIRECTLY
710 A$(114)=","                          'IN BASIC
720 A$(196) = "<BK>"                     'LOAD MORSE CHARACTERS WITH
730 A$(255) = "<EE>"                     'LARGE BRYANT CODES
740 A$(361) = "%"
750 '
760      REM:    LOAD PORT PARAMETERS.  DATA IS PORT ADDRESS AND BIT SELECT
770      REM:    USER MUST ENTER DATA BEFORE PROGRAM WILL RUN
780 READ I,J                             'READ PORT I, AND WITH J
790 DATA
800 RETURN
810 '
820      REM:    PORT READ SUBROUTINE
830 A = INP(I) AND J                     'RETURN A = 0 IF SIGNAL PRESENT
840 B=B+10                               'INCREMENT COUNTER
850 RETURN
860 '
870      REM:    SHIFT LEFT AND ADD ROUTINE FOR DOTS
880 DO=2*DO:DA=2*DA
890 DO=DO+1
900 RETURN
910 '
920      REM:    SHIFT LEFT AND ADD ROUTINE FOR DASHES
930 DO=2*DO:DA=2*DA
940 DA=DA+1
950 RETURN
960 '
970      REM:    ERROR TRAPPING ROUTINE
980 IF ERR=4 THEN 990 ELSE PRINT:PRINT "ERROR NUMBER";ERR;"AT LINE";ERL:RUN
990 PRINT "ENTER PORT AND BIT NUMBER IN DATA LINE";ERL+10:END
```

Program listing.

age of what is typed out is either incorrect, badly spaced, or both.

On the other hand, keyboard and computer CW are received very well. It is a great pleasure to run along at 50-60 words per minute, and this is where this kind of digital communication method comes into its own. We have had some excellent QSOs at these speeds.

In conclusion, I found the MFJ-1200 a very satisfactory unit. It performs well, and its price is well within a range most of us can afford. it can open new worlds to amateur radio operators and to those interested in shortwave listening. It gives the computer user a new area of exploration. Despite its "ancient" (1836) origins, Morse code remains a viable and widely used method of communication, especially in the maritime services. I routinely listen to UPI news, read weather broadcasts and telegrams, and decode Russian CW in addition to our usual amateur activities. If you are interested in a list of utility stations I have received, or if you would like a copy of Cyrillic CW, write me for more information.

The MFJ-1200 can be purchased directly from *MFJ Enterprises, PO Box 494, Mississippi State MS 39762* for $69.95 plus postage. If you need a power supply, add $9.95. Reader Service number 483.

William S. Hall
5621 Maple Heights Court
Pittsburgh PA 15232

References

1. Kurtz, R. L., "World Of the Brass Pounders: Receive Morse the Easy Way," *Kilobaud Microcomputing*, November, 1978.
2. Gillett, M., "CW and the TRS-80," *73 Magazine*, April, 1980.

THE FLESHER TU-170 TERMINAL UNIT

After searching through several years worth of back issues of *QST* and *73*, it became clear that for receiving RTTY tones almost all amateur sta-

tions were using 170-Hz shift, and that there are in general two basic types of demodulators in use, the phase-locked loop type and the filter type. It also seems that fancier stations have autostart capabilities: the capacity to turn on an unattended TTY when a remote station starts sending.

Further reading disclosed that phase-locked loop demodulators tend to work great if there is no interference or adjacent strong signal, but that they tend to lock easily onto strong, adjacent signals, which could be a problem in HF work. Filter-type demodulators, however, are somewhat more immune to adjacent strong signals. Even further reading disclosed that the Flesher Corporation of Topeka, Kansas, marketed a TU using the filter type of demodulator, and that the unit had a tuning meter, autostart, and a built-in loop supply. Also, Flesher markets the unit in either kit form or assembled and tested. A phone call the next day to Topeka resulted in a small bruise to my VISA card, and the arrival one week later of my TU-170 kit.

For those readers who are accustomed to Heathkit® instructions, the Flesher unit will not exactly bring smiles of joy. The instructions are adequate, but the kit is best assembled by an experienced kit builder. The instructions are straight to the point and lump similar steps together. (For example, "Install all diodes" on board.) The kit builder working from a pictorial of the board first installs the jumpers (there are eight), then the diodes and resistors, and then the integrated circuit sockets. Although the kit does not include IC sockets, a slip of paper in one of the parts bags informs the builder that IC sockets are now supplied and that they should be installed instead of the ICs called for in the instructions. I installed the sockets where it said to install the ICs, and did not insert the ICs until after completing all soldering.

The Flesher TU-170 consists of one single-sided printed circuit board measuring approximately 6" by 6", a heat-sink plate which mounts to the PC board and in back of the front panel, and a Ten-Tec-type chassis/cabinet which consists of a U-shaped front panel/bottom-rear panel, a top, and two sides. Construction takes between 12 and 20 hours, depending upon your ineptitude. A small pencil-type soldering iron should be used, and care should be taken to minimize the heat, particularly around the front-panel switches.

A special caution should be noted about the front-panel switches. They are very inexpensive and are especially susceptible to heat damage. Being of frail plastic design, if too much heat is applied to the contact posts, the plastic body may become soft, allowing the contact post being soldered to move and the switch to become inoperative. If this should happen, as in my case, a call or letter to Topeka will result in a new switch arriving about one week later. Do not bother, as I did, to try to find a replacement switch around town. A search of Los Angeles found no suitable switches which would exactly fit the square hole in the Flesher front panel. The factory is very polite and helpful in such situations, but it does take about a week from the time they are notified to get a new one.

Other rules of kit building that one should observe include:

1) Follow the instructions!

2) After finishing the PC board, check each component for correct value and orientation, as well as for a good solder connection. Also check for and remove any solder splashes.

3) Do not rush!

4) Use a good wire stripper, not a pair of cutter pliers.

5) Do not rush; follow the instructions.

Assuming that you observe the above cautions, it is highly probable that a completed TU-170 will appear several nights after you started, along with some burn marks on several fingers.

Before discussing alignment, it is useful (as they say in the text books) to look at the Flesher TU-170 from the functional point of view. Fig. 1 shows a block diagram of the unit. It is divided into three major functional blocks: the demodulator with autostart and loop-keying circuitry, the modulator, and the power supplies.

With the exception of the autostart line-switching solid-state relay, meter, switches, jacks, and input/output terminal board, all of the circuit components are mounted on the 6" by 6" PC board.

Details of the demodulator are shown in Fig. 2. The audio input from the transceiver, containing the mark tone at 2125 Hz and the space tone at 2295 Hz, passes through the mark and space filters and is then rectified. The negative half of the filtered space signal or the

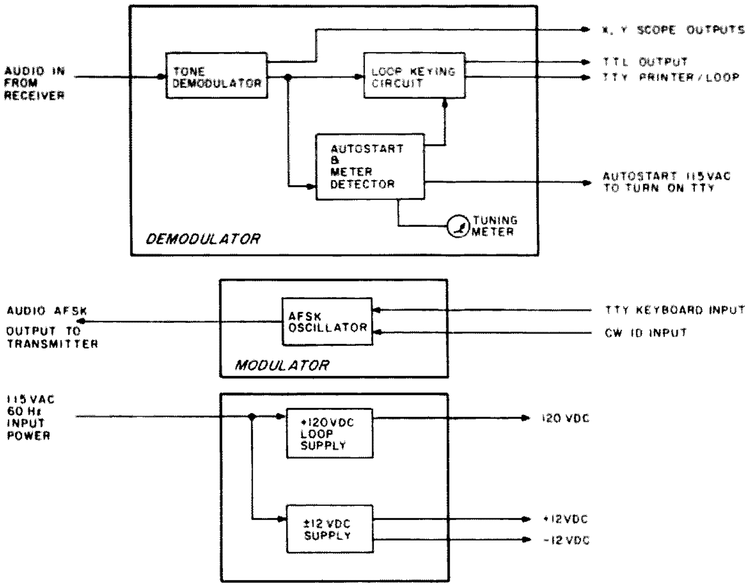


Fig. 1. TU-170 terminal unit functional block diagram.

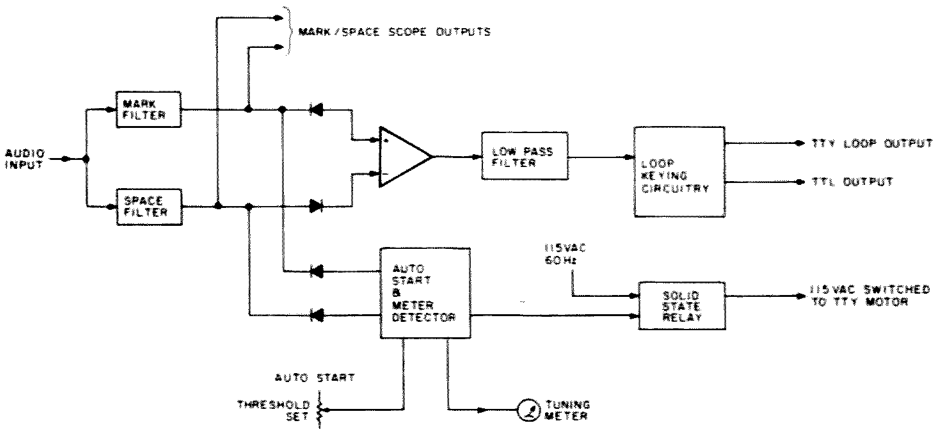


Fig. 2. Demodulator detailed block diagram.

positive half of the filtered mark signal then drives an amplifier either hard positive or hard negative. The output of the detector then is low-pass filtered to remove the high-frequency audio components, and then squared off and sent to the loop-keying circuitry. The loop-keying circuitry switches the + 120 V dc which runs the TTY printer magnets.

For computer enthusiasts, a TTL-level output is available. Also available at the mark and space filter outputs are high level signals (15-volt peak-to-peak) to drive the horizontal and vertical channels of an oscilloscope. The mark signal is normally applied to the horizontal channel, and the space signal to the vertical channel of the scope. These signals will provide a cross or crossed-ellipse pattern when connected to the scope when the RTTY signal is properly tuned.

The filtered mark/space signals also have their negative halves rectified and are fed into the autostart/meter detector. The front-panel meter will indicate maximum deflection when a signal is properly tuned. The autostart circuit will turn on 115 V ac through a solid-state relay when a RTTY signal is present. The 115 V ac may be used to turn on the TTY motor. A front-panel potentiometer allows the autostart detector to be set at any desired minimum signal level, thus avoiding activation of the TTY on noise or low-level signals. The transmit and receive modes are controlled by the Send/Rec switch on the front panel. A set of contacts on this switch sends + 12 V dc to the loop-keying circuit, thus preventing spurious output from the demodulator from keying the printer during transmit. A second set of contacts on the Send/Rec switch can be used to trip the push-to-talk circuit on the transceiver.

The TU-170 modulator generates the audio mark/space tones. Fig. 3 shows a block diagram of the audio modulator. The TTY keyboard contacts provide a switched loop voltage which, after going through the loop-keying circuit, provides a high- or low-level input to the modulator. The frequency of the modulator is generated by a 555 timer/oscillator integrated circuit. By changing the value of the resistance in the 555 frequency-determining components, either a 2125-Hz mark or a 2295-Hz space signal will be generated. A high input to the modulator will cause a mark to be generated, and a low input, a space.

For a space, the frequency is changed by a transistor and FET which switch a resistor in parallel with the mark-frequency-determining resistor, thus presenting a lower resistance to the 555 and causing a higher frequency to be generated—in this case, a 2295-Hz space frequency. For CW ID, a separate Input is provided which changes a capacitor connected to the 555, thereby providing for a 100-Hz shift for a key to send your call in shifted CW.

The output of the 555 is filtered through an active filter. A pot allows the filter to be centered and, therefore, equal amplitude on both mark and space signals can be adjusted. The 555 circuit and filter provide a very clean and coherent signal.

Alignment of the TU-170 is very straightforward. First the modulator is set to the correct mark and space frequencies. A counter is needed for this step. The mark is set first by adjusting a potentiometer. Then a jumper from + 12 V dc will switch the 555 to a space and the space tone pot is set for 2295 Hz. During the first hour or so of operation after power on, some drift will be seen on the counter for both the mark and space frequencies. About 10 Hz over an hour's period was observed. Since both the mark and space tones drift about the same amount, this will present no problem *for amateur* demodulators since these small drifts are well within the demodulator's bandpass.

After setting the frequency of the mark and space tones, their amplitudes are set by a third pot to be about equal. An oscilloscope or a VTVM is needed for this adjustment. The tone output then is jumpered to the demodulator input, and the mark and space filters are adjusted. Three pots in each filter are adjusted for maximum deflection on the front-panel meter. Add a cover and sides, and the TU-170 is completed. The unit now is about 7.25" wide by 3.25" high by 7.25" deep. It is grey and black, and rather attractive. It easily blends into most stations.

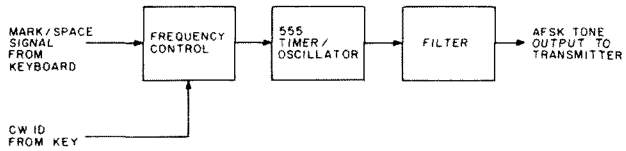


Fig. 3. Modulator detailed block diagram.

The next step is to hook up the TU-170 to the station transceiver and teletype. I use a Yaesu 227R here, on 2m FM. Yaesu has thoughtfully provided all of the necessary connections needed on an accessory connector on the rear panel of the 227R. These signals are: push-to-talk, microphone audio input, and speaker audio output. I leave my speaker connected while in the RTTY mode so that I can hear the tones and know that everything is OK.

You should use shielded cable for all connections between the TU-170 and your transceiver. Multi-conductor cable with a single outside shield is OK, but I used separate lengths of individually-shielded wire for each signal. Just use good techniques and you won't have any problems.

If your rig does not have an auxiliary connector with the proper signals available, then you can use the microphone input jack and earphone/speaker jack. If you do use the auxiliary connector, as I did, the TU-170 modulator will be in parallel with your transceiver microphone. When receiving, you then will hear a tone coming out of your microphone, since the TU-170 is always generating a tone whether it is in transmit or receive. The microphone in this case acts as a speaker. Also, *you* probably will not be able to transmit on FM voice when the tone is on, since it is strong enough to drown out the audio from the microphone. The simple solution is to turn the TU-170 ac power switch off whenever you are in the FM voice mode. An alternate solution is to add a switch to the TU-170 to disable the 555 oscillator. A number of other stations use computers on RTTY in our area. The TU-170 has TTL input and output lines to allow it to be connected easily to your favorite computer.

Once your hookup is complete, you are ready to start. I would suggest that you listen at first to get a feel for how conversations are held. Good operating practice is to wait after a station has signed to allow others to break in. When you feel ready, jump in with your call.

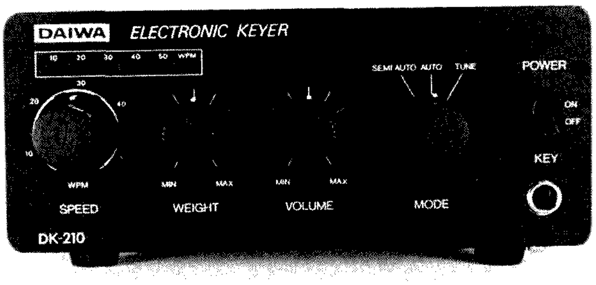
Well, there you have a description of my first experiences with RTTY. The Flesher TU-170 has now been in use here at WB6CRD for some time without any problems whatsoever. It Is a first-class unit for either the beginner or the old-timer, and can be used with computers. The world of RTTY has now been opened to me, and it is a fascinating world. I highly recommend it to you.

The TU-170 is available in kit form for $169.95. For more information, contact *Flesher Corporation, 507 Jackson, PO Box 976, Topeka KS 66601.* Reader Service number 484.

Tony Gitt WB6CRD
Culver City CA

DAIWA DK-210

The gang at *73* knows I'm a CW freak and spend most of my time at the low end of the various bands, hanging out with others of like persuasion. For years, I've been using a time-honored but somewhat passé



The Daiwa DK-210 electronic keyer.

"TO" keyer...one of the tube-type keyers made by Hallicrafters as the HA-1...but still a real standard in many shacks, even today.

Like many of you, I suspect, I didn't even know that Daiwa made a keyer. Sure, we all know about their swr and power meters...the ones with the "crossed" pointer readout... and we know about their line of antenna tuners, but a *keyer*?

First impressions are important, and Daiwa doesn't let us down on this vital part of product marketing. The Daiwa DK-210 electronic keyer comes in the expected plastic-wrapped package with accessories separately wrapped and packed in the same carton. These include two RCA phono plugs, a power cord, and a power plug.

The DK-210 is dark grey in color and feels quite heavy... heavier than you'd expect for its size...a quality feeling. The crinkle finish is well done, and the front-panel markings stand out clearly against the dark finish color.

In this model, there are five small rectangular LEDs in the upper left-hand corner, surrounded by a white outline. Each LED is labeled with a number: 10, 20, 30, 40, and 50 (wpm); more about these later. The left-hand knob is labeled SPEED and obviously sets the speed of the dots and dashes generated by the keyer's electronics. A segmented circle around the knob is marked with the same numbers, corresponding to the LEDs...again an obvious (but welcome) feature.

A second knob is labeled WEIGHT and has a scale whose limits are marked MIN and MAX. This knob controls the dot-dash ratio and space; at MIN, the ratio is exactly three to one... that is, the length of time occupied by one dash is exactly equivalent to the time occupied by three dits. If you like to slur your keying and send code that has a different ratio, you have plenty of adjustment to play with. I would guess that beyond about the ten o'clock position of the pointer on the knob, you might succeed with a setting that nobody could decipher!

The DK-210 has a built-in speaker and tone generator so that you can monitor your own sending. The tone is pleasant and sounds something like the monitor of the transmitter itself. There is an external volume control, while the tone's pitch may be adjusted by a small screwdriver-slotted plastic shaft on the rear panel of the keyer. As it was received, I'd guess the tone was about 700 Hertz...just right for my ear, so I didn't bother changing the pitch. If you like stereo, you can use the transmitter's own keying monitor playing counterpoint to the built-in keyer monitor. I do that sometimes to relieve the monotony of a single tone.

A rotary switch allows you to select SEMI-AUTO, AUTO, and TUNE. In the SEMI-AUTO position, dots are generated automatically but dashes must be made manually, like the old-fashioned bug keyers. In the AUTO position, the key is a full electronic keyer with all automatic functions, including the desirable iambic-keying capability...something I've not yet taught myself to use. No matter—it works just fine with my old-fashioned type of thumb and forefinger input. (One of these days, though, I've got to learn to use iambic, or "squeeze," keying as it's called.)

The tune position is to allow you to turn your transmitter on in the way you used to do by holding the old pump handle in the down position...that is, to make a steady tune-up signal on the ~~band~~, er...ah, the dummy load. Finally, at the extreme right side of the front panel is the toggle switch that turns the power on and off, as indicated by an LED just above it. Below the toggle switch is a standard quarter-inch phone jack. Naturally, I had to change mine from the one I had on it back to the standard! Oh, yes, I almost forgot: It's labeled KEY and that's where you plug in your paddle.

On the back panel there's an accessory power-input jack for the usual 8-to-13.8-volt dc power-input plug...the style that you are used to seeing on tape recorders and other electronic devices that need that kind of power. More about *this* later, too!

Two RCA-type phono jacks are also on the rear panel. One is red and the other, black. The red one says DIRECT and the black one says GRID BLOCK. This means you can use the Daiwa 210 to key an old-fashioned cathode-keyed rig (limits are 300 V, 100 mA, max.) or one of the newer rigs in which the grid of a control tube, or a solid-state device, is keyed (limits are −100 V, 10 mA, max.).

Having an Icom IC-720A to key, I used the grid block outlet and managed to use one of the accessory phono plugs thoughtfully provided by Daiwa. Next, I looked for a source of power. Failing to locate an appropriate source of 12 volts dc with the proper plug right away, I decided to remove the top cover of the keyer (per instructions) to locate the battery holder...and install a 9-volt battery.

Whoopee! The keyer lighted up and a few dots and dashes caused the LEDs to glow...first the 10, then the 20, and finally the 30...sort of a progressive display running from left to right. The instructions suggest that if you run on battery power it would be a good idea to disable the LEDs to reduce power consumption. Likewise, it would be a good idea to forgo use of the keying monitor/speaker.

I quickly tuned in a station, gave him a call, and asked for a critical keying-quality report. The reply was a definite "Sounds great here, OM." I was in business!

All that evening I used my keyer, even forgetting the 300-mA current drain, until the battery started running low. Low battery power is evidenced by the keyer failing to keep up the set speed and the LEDs failing to light up. The "weight" is not affected, however.

Knowing that my time on remaining battery power was limited, I decided to hook up the small utility supply I had to provide all the power I would need for a weekend of CW. Easy, I figured...just do the normal thing...hook up the positive lead to the center pin, the negative lead to the shell, and *oops*! Immediately I suspected my supply, but that turned out okay. A closer look at the input jack on the Daiwa showed the reason (I needed a magnifying glass to read it). The center pin, friends, is negative while the sleeve is positive! After changing the leads on my supply, I got an immediate indication of all being normal and happy with the keyer.

I checked the LED indication of speed (in which several characters are integrated by the circuitry to read out an average speed) and the dial setting of speed, and they seemed to coincide very well. My normal conversational keying speed is around 30 or 35 wpm, and that's where I set the speed control; it also was what the LEDs indicated I was doing. I found that at higher speeds a slight slurring of dots and dashes is smoother sounding, and this was easily achieved by adjusting the "weight" control pot to about the 9 o'clock position. Just enough to make it pleasing to my ear.

The 6-inch-wide, 2.5-inch-high, and 6-inch-deep box hardly occupies any space at all on my operating desk. In fact, it's so neat-looking and so unobtrusive that I have given it a place of honor right next to my transceiver...which it complements beautifully. Altogether, I guess I've operated the little Daiwa 210 electronic keyer about 25 or 30 hours now, and it hasn't missed a beat.

Complaints: none, except at my own stupidity for not reading the nice little instruction brochure with its illustration of polarity on the power plug plainly shown! I have known for years that one ought to read the instructions first, but—like many of us—I figure it's so simple that reading instructions isn't necessary. Well, I learned.

I don't have much stray rf floating around the shack as all my antennas are current-fed, and the high-voltage points are far removed from the equipment. Nevertheless, if you end-feed an antenna and bring it into the shack to your tuner, you might have to use shielded keying leads between the output of the 210 and your transceiver. Rf has a funny way of producing not-so-funny results with solid-state devices.

Anything else? Just one thing: Daiwa also makes a nice version of this keyer without the LEDs, and it's called the model 200. Just in case you don't care for the speed-readout system, or don't feel it's necessary, or maybe want to save a few pennies, you might prefer the 200.

The DK-200 is priced at $82.50 and the DK-210 sells for $99.50. Daiwa keyers and instruments are distributed in the United States by *MCM Communications, 858 Congress Park Drive, Centerville OH 45459.* Reader Service number 480.

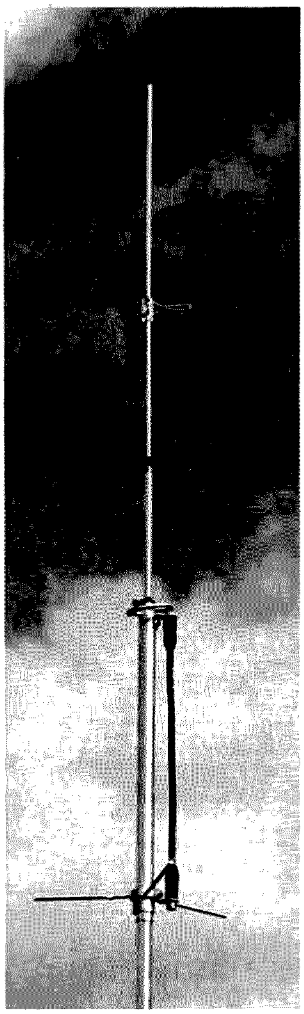
James Gray W1XU
***73 Magazine* Staff**

NEW PRODUCTS

BASE STATION ANTENNA

Ringo Ranger II is the newest addition to the Cushcraft line of Proline base station antennas. This improved model has 5.5 dB gain with an additional 5/8-wave section and decoupling radials for a low angle of radiation. All Ringo Ranger II antennas are broadband and easily field-tuned for quick installation. They are made from aluminum, with stainless steel hardware.

There are models covering the frequency range from 146-512 MHz. The Ringo Ranger II is priced at $49.95. For more information, contact *Cushcraft Corporation, PO Box 4680, Manchester NH 03108; (800)-258-3860.* Reader Service number 479.



Cushcraft's Ringo Ranger II base station antenna.

CALLSIGN DISPLAY

G & T Service Company offers a 3" x 8" callsign display. It is available with black, blue, red, green, or woodgrain background and white letters, or a white or yellow background with black letters. G & T also offers a clear Plexiglas™ holder. The callsign display sells for $6.00 plus shipping. For more information, contact *G & T Service Company, 3210 N. County Line Road, Farwell MI 48622.* Reader Service number 476.

ICOM IC-740 HF TRANSCEIVER

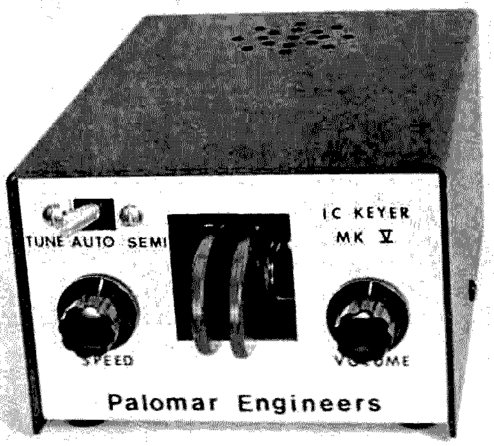
The Icom IC-740 is a versatile transceiver with front-panel or top controls that allow access to all operating functions. Adjustable receiver parameters include rf preamp, rf gain, noise blanker (width and level) i-f shift, passband tuning, crystal filter in/out, notch filter, agc (time constant and on/off), squelch, tone, and audio gain. Transmitter controls are mike gain, VOX, compressor, and power (10-100 W). The IC-740 includes capability for operating in the FM mode.

The frequency synthesis network includes dual vfo's with three tuning rates, split operation, and memory. Analog control of frequency with the incremental tuning on either TX, RX, or both. Full metering of receive-signal strength, transmit-relative rf output, compressor level, ALC and collector current, plus a built-in swr meter.

A large selection of options allows tailoring the IC-740 to your needs: a frequency marker, FM module, built-in electronic keyer, two 9-MHz i-f CW filters, three 455-kHz i-f CW filters, and optional internal power supply. The suggested base price for the IC-740 is $1099.

For more information, contact *Icom America, 2112 116th Ave. NE, Bellevue WA 98004.*

The Icom IC-740 transceiver.



Palomar Engineers' MK V electronic keyer.

PALOMAR ENGINEERS' ELECTRONIC KEYER

Palomar Engineers has announced the new IC keyer, the MK V. It features a 1-Ampere silver contact relay output that will key all ham rigs and most shipboard transmitters. It keys either polarity without change of jumpers.

The keyer features the fully-adjustable Ham-Key paddle and Curtis IC. It is available with either standard operation or type-B action. The keyer has a sidetone oscillator, speaker, volume and speed controls, mode switch, and an internal pitch control. It operates from a clip-on 9-volt battery for complete portability, or you can use a 9- or 12-volt dc power supply.

The MK V sells for $132.50 plus shipping/handling. For more information, contact *Palomar Engineers, 1924-F West Mission Road, Escondido CA 92025.*

AUTOCONNECT'S AUTOPATCH

AutoConnect introduces Private Patch. Since Private Patch does not employ the sampling technique, there are no repetitious squelch tails. In addition to simplex capability, AutoConnect's technique of audio and digital signal processing also permits operation through repeaters.

A five-digit user-programmable access code and long distance/operator-restrict switch protect your phone bill. A front-panel ringback switch permits incoming calls when desired.

Additional features are CW identification and a six-minute shut-down timer with reset code for additional talk time.

The Private Patch's introductory price is $489. For additional information, contact *AutoConnect, PO Box 4155, Torrance CA 90510.* Reader Service number 477.

THE GLOBAL SPECIALTIES SOLDERLESS BREADBOARD

Designed specifically for microprocessor applications, the new PB-105 solderless breadboard from Global Specialties Corporation contains five binding posts, 18 distribution buses, and six solderless breadboarding sockets. The 9.2" x 11.4" x .05" (234 x 290 x 1.3mm) "Superboard" offers 50 percent more breadboarding area (up to 48 14-pin ICs) than the next smaller size.

Conductive spring clips within the breadboard body securely grasp component leads and connecting wires. Parts plug in and pull out without damage. Vinyl feet are mounted to the underside of the backplate to prevent slipping or damage to the bench top.

Proto-Board assemblies are engineered for use in design, test fixturing, quality control, prototyping, evaluation inspection, and custom circuit applications. Suggested US resale price is $115.50.

For further information, contact *Global Specialties Corporation, 70 Fulton Terrace, New Haven CT 06509; (203)-624-3103.* Reader Service number 484.

MFJ ACTIVE RECEIVING ANTENNA

MFJ has introduced a new active outdoor receiving antenna with outdoor whip that gives reception of 50-kHz to 30-MHz signals. At lower frequencies, it is equivalent to an outside wire antenna hundreds of meters long. At high frequencies, it has high-gain amplifying action.

A high-dynamic range rf amplifier is mounted at the antenna for maximum signal-to-noise ratio. A 20-dB attenuator switch on the control unit prevents receiver overload.

The new antenna comes complete with a 50-foot coax cable with connector. It is available from MFJ Enterprises, Inc., for $129.95 plus shipping and handling.

For more information, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 478.

CORRECTION

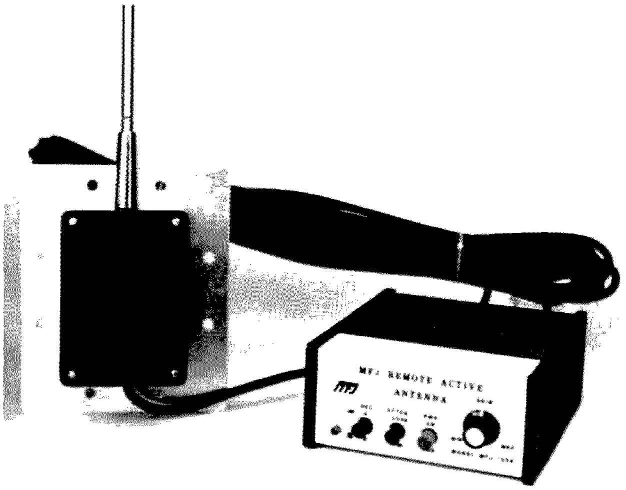
Please note that the TMAC Products weather station mentioned in our July issue (page 106) is powered by 115 volts (*not* 155 volts as stated).

THE DYNATRACER DT-1 CIRCUIT ANALYZER

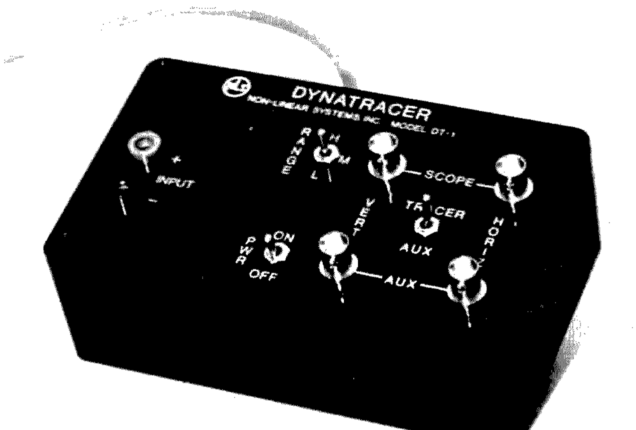
Non-Linear Systems, Inc., has added the DT-1 Component Signature Analyzer as a companion to its line of miniscopes. Designated the DT-1, the instrument has a capability as an in-circuit tester producing displays distinctive to the particular component or circuit being tested without the application of power to the circuit under test. DT-1 can be used with any oscilloscope equipped with an X-Y input.

The unit will display on the associated oscilloscope screen waveform pattern the condition of any component or group of components within a circuit. Accessories include a test-lead assembly, BNC-to-BNC cables for attachment to scope, and a unique component test adapter for testing radial-lead components without test leads.

The price for the DT-1 is $150. For more information, contact *Non-Linear Systems, Inc., PO Box N, Del Mar CA 92014.* Reader Service number 481.



The MFJ outdoor active receiving antenna.



The Dynatracer DT-1 circuit analyzer.

LETTERS

PRO CODE

I just wanted to get my two cents in on dropping the code as mentioned in Wayne's editorial. Like the column "Never Say Die," in my opinion, "the code never will." Code has always been a great part of ham radio and I hope it stays. Code is a language everyone can enjoy and communicate by. It took me quite some time to learn it, I grant you, but I stuck with it. If you want something bad enough, you can do it—and with great satisfaction.

Sounds like code came very easy for you—5 wpm in one hour. You must not have enjoyed something coming so easily, since now you feel code should be abolished. My spelling is terrible and I learn slowly. But I made my Extra and sure am proud of it. And if I can do it, most anyone can.

I'm sure glad Garth Evans is on our side of the fence. Like Garth said, "you have to dangle a carrot in front of the horse to get more privileges." Wayne, you say Bash is cheating, but are you sure you're not getting some kickback from Bash? Because with no code test, all you have to do is buy a Bash book, read a few hours, and you'll have your ham ticket. By the sounds of it, Wayne, you would like to see the ham bands turned into another 11 meters (chicken band). Well, that's my two cents. All in all, Wayne, you have a great magazine, but not all your opinions are great.

Ron Ostman KA0AYN
Eden Prairie MN

Ron, I admit that my opinions may not seem all that great if you ignore most of what I write and take little bits out of context and try to argue about them without mentioning the rest. Never have I ever suggested doing away with the code test and then leaving everything else the same. I guess you just read little parts of what I write and then wonder why I am not clear in my thoughts. You must really think I

am stupid if you think I want any of our ham bands to be like a CB channel. No, whenever I suggest canning the code, I also tie with it a much more serious technical exam, one which Bash will be unable to compromise. We have what is supposed to be a technical hobby, not a skill hobby, and the entry exam should reflect this.—Wayne.

NO CODE

I've read and reread your thoughts about code-free amateur licenses in the March issue of your mag, and hope someone out there listens to you. I've wanted to become a ham since I got into electronics in 1946 (remember the old jokes about the "drip pan for the grid leak?") but have simply *no* interest in learning Morse code. The technical side of ham radio and electronics in general is fascinating to me, and I spend much of my free time working up a new circuit I've seen somewhere or trying to keep up on technical reading (that could be a full-time job nowadays!). Of course, *73* occupies a few hours every month.

I designed high-fidelity amplifiers back in the '40s when nobody else knew what I was talking about and thought I was kind of nutty. I made the transition to solid-state with only mild trauma. I even went the CB route for a short while, but gave it up. They are, generally, foul-mouth rednecks with IQs in the low 80s or so. There are some exceptions, sure, but they are too rare. I have a lot of reading and research to do on TVRO now (great series by WA4CVP and WA4OSR you've been running lately), so I'll take out my frustrations on the microwaves. Keep up the good work.

Jim White
Sacramento CA

WELFARE ATTITUDE

Here I am again, reading the June *73* Letters column. Seems as though you continue to bash away at Bash, and your no-code license controversy goes on unabated.

Assume for the moment that you get your way. The most obvious question is, how do you propose making your theory test Bashproof?

As for the club idea, it has been my observation that most clubs, no matter how enthusiastic they start out, soon deteriorate into the usual 5% doers and 95% hangers on. It would seem that the result would be to put into the hands of a few elitists the power to decide who gets a license. A disinterested FCC bureaucrat hireling is probably best qualified to apply the rules equally to all applicants.

I think the basic problem lies not specifically with ham radio, but with our society in general. Only when the pride of personal accomplishment replaces the welfare attitude will Bash die and amateur radio grow—no matter what the entrance requirements.

Henry Testa KB6PM
San Diego CA

Henry, it isn't our society that is different. . . people have always been like that. People do things because they enjoy them and feel some sense of responsibility and accomplishment. The more we get people involved in amateur radio with responsibilities, the more enthusiasm I think we'll have. Amateurs who have been around for ten years can remember the real enthusiasm of the FM and repeater pioneers. Clubs formed all around the country. We had growth, enthusiasm, and excitement.—Wayne.

EMERGENCY SYSTEMS

I have been a reader of *73* since Wayne started it in Brooklyn NY, and have been an avid reader of the "Never Say Die" column. I must make a few comments on your June, 1982, issue.

You are advocating a national policy for emergency communications, which, by the way, I agree with with only one difference. I am afraid, Wayne, that our equipment is becoming so complex and sophisticated that very few hams have the capability and know-how to maintain/service same. In a real emergency, when the big national/military systems have gone up in atomic smoke, most of our present equipment will have gone the same way through the action of EMP (see AK0Q's article in the same issue). This guy knows something that few hams know.

I am retired now but have been involved in military communications planning for many years and have come across this subject many times. Much of the material is still in the Top Secret drawers. While the military can replace its black boxes because they have thousands in reserve and cost is no object, the poor ham is out of business when all our beautiful idiot lights are out. I suggest you give this some thought and, instead of advocating more sophisticated emergency equipment, let's think of survivability also. The only way to survive in my opinion is if hams can maintain their own equipment with minimum reliability on the manufacturer. Yes, I am thinking the unthinkable. Emergency equipment should be simple tube equipment, with at least one of each tube on the shelf in reserve. Above all, it should be maintainable.

Also, Wayne, let's face it: If the unthinkable ever happens, there will be no power and no gas for our gas-guzzling generators, so all of our emergency equipment should be battery-operated with, perhaps, a solar trickle charger. Some enterprising company might be induced by you to engineer a packaged transceiver/battery power system at reasonable cost and simple to maintain, remembering that it will have to be used and maintained when all has gone up in smoke.

I am sure that there are enough amateurs in every state to organize a truly compatible national emergency system. With your persuasive powers and *73 Magazine*, I am sure it can be done. I am truly interested in seeing such a system established, because I know that should the big cloud ever rise over New York, Washington DC, Chicago, etc., etc., all other systems will be down. There will be no power, no telephone, no commercial radio, and no transportation. Only a truly compatible, maintainable amateur system can survive.

Hope to hear more on this most important subject from you. Keep up the good work, Wayne. We need more like you.

Arnold Samuels KH6COY/7
Ocean Shores WA

Oh, I'm familiar with EMP, those electromagnetic pulses which accompany nuclear bombs. Getting information on the subject is difficult, but there have been some good articles in the more technical journals. It appears that unless we are hit close enough so we won't be around to worry about it, most of our solid-state ham gear will survive. . . particularly if it is not connected to an outside antenna. One of the nice things about solid-state equipment is its ability to run from twelve volts. Now, we may have a shortage of 120 V ac to run tube equipment, but it is going to be a long time before we run out of 12-V dc sources. You can even run transistor equipment from solar cells if you have to, but forget it with tubes. If you are worried about servicing the more complicated electronics, I suggest you turn the job over to a teenager, if you can find one. You've been spending too much time in the company of old-timers who are afraid to even try to fix transistor and IC circuits. Kids plunge right in and have a ball. . . and fix them. I can remember back to my early days in amateur radio when I built anything I wanted, fixed anything, and had a ball. —Wayne.

EX-DEALER CONFESSIONS

I was an amateur radio dealer. After many years of screwing around with the hobby, I found myself on the other side of the counter. The excitement was profound and when our first big order arrived, you can imagine the feeling. I mean, gosh, golly, see, I can open any one of those boxes and play to my heart's content. Anyone else would call it a mental disease but we call it being a "ham."

Imagine what it was like getting ready for opening day. All the expectations were there in full force. The doors went open, the phone was activated, and the ads were placed. And they came, saying, "Hey, this is great—we have a real ham store in town!"

For a few weeks it was, without a doubt, the peak of my long involvement with ham radio. What ham could ask for anything more? Then it started to happen. "Can't you fudge the tax for me?" "How about a better discount?" "Can't you ship the box to a friend in Pennsylvania and let me take the rig?" I actually shipped a cinder block in a Yaesu box to PA. Guess what happened. The damned block broke up, UPS

opened it and discovered the contents, and sent an inspector to investigate! Needless to say, I felt like a jerk and had a hard time explaining that one. I said it was just a joke. Dumb people do dumb things.

Then came the advent of CB. Not normal CB, but HF CB. All of a sudden, strange people were selling the same equipment I was—out of their garages and basements. I was one of those high-minded nincompoops who refused to sell to the HFers and required a ham license in order to buy a transmitter. Although I was able to purchase the equipment cheaper than these pseudo-dealers, I couldn't fudge the tax and I wouldn't "clip the brown wire" and cater to those illegal operators. You can see right there that I was never gonna make any money.

I would go to a hamfest in my own state and have to stand there like a jerk while an out-of-state dealer beat me out by not charging sales taxes! Complaining didn't do any good. Finally, after I went out of business, all hell broke loose at the Rochester hamfest. The state was wrong in their tactics but right in principle. Everyone in New York State lives with sales taxes and I don't see any of them pounding on the walls. It's ridiculous for hams to expect special consideration just because they're hams. If I was a hot-shot model-airplane enthusiast, I don't think I could expect to be exempt from sales taxes because my little airplane could fly typhoid serum across a flooded river in an emergency. We all do what we can.

When you operate a business, you're faced with all sorts of expenses. Aside from the normal bookwork, you have the state and federal government taking up a good percentage of your time. Then there's the overhead in keeping a walk-in showroom going. Insurance, upkeep, test equipment, tools—the list goes on and on.

Then there is "salesmanship." I'm a technical type and always tried to give the inexperienced the benefit of my knowledge. Unfortunately, most hams are already "experts" and no matter what you tell them, they know more than you do or their "buddy" does. The real culprit is the attitude of most amateurs. There was once a day when the amateur was accepted as a fairly knowledgeable radio type. He got discounts at the local radio store. Today, it's a different story. Amateur radio is a limited, special-interest hobby and is treated as a consumer item by the big importers.

The majority of rigs (at that time) were being sold to the HFers and not the hams. That was the era of the "Big Boom." This consumerism approach forced prices down and discounts were given because of the competition (via the 800 numbers). It was no longer feasible to keep an open showroom for people to come in, try the gear, make their decision on what to buy, and then call an 800 number and order to beat the tax. To make a long story short, the doors were closed.

I will be the first to agree that price is important. The only useful purpose of a local dealer is convenience—providing the opportunity to inspect and try the gear you're interested in and being there for service. But hams don't care about paying for service or convenience. After all, the manufacturer provides a warranty.

The only way any dealer can make it is to rely on mail-order sales or locate in a highly populated area. More significant is the realization that all this could end should the manufacturers and importers decide that they don't need dealers. Since they are providing the warranty anyway, they could install an 800 number and take over sales. Once the majority of the big outfits did this, they would have absolute control over pricing. As I stated, "ham radio is a limited, special-interest hobby" and there is no need for discounting. People don't build anymore, so where would you go to "beat the price?"

Once I discovered the requirements of a likeable and lovable dealer, I realized that I couldn't make money at it. I didn't have the personality for it. I couldn't stand cheapness, I couldn't stand listening to a guy who just went to Radio Shack and bought his coax and then came to me and bitched about the price of a couple of fittings. Yuk. I had guys who actually complained about paying a seven-cent sales tax on a dollar item. I've had people buy their radios elsewhere and come with a rig under their arm looking for warranty service. I've had people order parts for their gear and say, when I called them to let them know they had arrived, "Oh...yeah...I fixed it... don't need the parts anymore." A month later they call again: "Hey, can you fix my rig?" (Click.)

No, it wasn't all bad. I've had guys come in, pick out the most expensive units, never dicker on price, pay me in ones (from every pocket), and depart never to be seen again. That's when you crawl off in a corner muttering to yourself (or isolate yourself in the john with a copy of *MAD* magazine).

Yes, there are days when I miss it. I miss getting to play with all the "goodies" and being up-to-date with the industry. I miss the rumors of who is getting the favoritism and the best buys, and I especially miss getting the news about a new model, not from the maker or importer, but from the magazine ads (the model that's announced before Christmas—the one you order gobs of for the big rush in sales—only to receive maybe one and then get them all a month later when nobody is interested). I miss the double shipments, I miss getting all the accessories for an old model and not the new model. I miss all the trade-ins that blew up in my face. I miss hearing from the government that I didn't send in enough withholding. I miss getting ready for the next big hamfest. Yes, I miss it. The problem is that I couldn't make a living at it. In a sense, any present amateur radio dealer is giving his customers much more than they deserve, or he wouldn't be in business. I was not willing to give that much.

If you have a local dealer, support him even if you don't like him. You may pay a little more for the convenience but, in the long run, you'll find it's worth it. There is no way he can get rich and the only reason he is there is because he loves the hobby —one thing you both have in common. After he is gone, nobody will replace him. My business could have survived by concentrating on mail-order sales, but the profit level would not have matched money-market earnings. I think this is true with any dealer.

I just ordered a new Yaesu receiver. I did as most of you. I looked at the ads, found the "BESPRIZ," called the 800 number, used my charge card, and am now awaiting the brown UPS truck. It's so impersonal. There's no one I can go to locally, no one to bitch about the tax to, no one I can expound my knowledge to, no place I can run into fellow hams to BS with, no dealer I can get irritated with because he's had a bad day and is nasty. Hell, it's no fun at all. I think I'm becoming an "old-timer." I can build a radio out of a safety pin and a razor blade. Can you?

Jim Beckett WA2KTJ
Corning NY

CCD ANTENNAS

Cheers to the multitude of you (literally) around the globe who have phoned and written us about your success with the 5-dB-gain W4FD Controlled-Current Distribution multiband dipole (as described in our *73* articles in October '78 and July '81; also see the May '82 issue).

We are pleased that the United States Navy has appropriated monies to construct CCD antennas. (Here is an excellent opportunity for anyone wishing to manufacture, under very reasonable licensing conditions.)

Thanks most of all to this great magazine for bringing our story to you and for granting us permission to reprint the latest construction data. You may have a copy for a small, one-stamp SASE.

Gene Brizendine W4ATE
(800 Hummingbird Dr. SE
Huntsville AL 35803)
Harry Mills W4FD

AMATEUR HIGHWAYS

I wonder what you might think about getting the FCC to rescind the ruling giving extra privileges to the Advanced licensees in that these hams get the private use of the lower 25 kHz in the CW segments of the bands?

My idea on this is related to the use of the highways. Driving the roads and operating in the amateur spectrum are privileges granted by public agencies. Operators must show prudence and abide by the rules and regulations.

The highway privilege is expressed in several classes of licenses: Extra or Advanced for truckers, bus drivers, etc., and

General and beginners for the rest. The Advanced exam is given to help ensure good and safe driving skills. But these Extra class drivers share the highways right along with the General class and even the beginners.

In view of this, why should the ham bands be segregated? It seems to me to be a form of discrimination. The amateur bands are just that for amateurs of all classes. The Advanced or Extras may not think it, but they are still amateurs. Radio operating skill doesn't come with technical knowledge.

QRM keeps increasing with more contests and RTTY stations. By returning these 25 kHz to the majority of amateurs, our privileges would return to us more enjoyment.

C. M. Johnson W6EOT
Lakeside CA

C.M., your attempt at reasoning is weird, possibly brought on by having spent too much time in California. In the long run, I favor splitting up our bands the way we all agree they should be split up, with no FCC regulations on this at all. But if you think 25 kHz is going to give you more room to operate, you have another thing coming. That would be swallowed up so fast you would never know it had been there. No, if there is too much interference, we either have to move to bands which are not as crowded (and there are plenty of them) or else start working on communications modes which use our frequencies more efficiently. If you change to RTTY you will be able to communicate about five to fifty times as fast, thus having to be on the air much shorter periods, leaving some spectrum for others to talk. Just by using already known (but not used) techniques, we can communicate at 8,500 words per minute. Should we have a special express lane on your highway for 200 mph cars or do they have to drive at 55 mph along with the trucks and buses?—Wayne.

FIJI DX

As DX of some scarcity, although not really that rare, I must endorse Wayne's comments on pileups.

For DX stations, the first time at the bottom of a pileup is so terrifying that many never come back. On 20, for instance, many keep out of the American phone band for that reason.

My own technique, one which has enabled even the QRP stations to achieve a successful QSO, is somewhat similar to Wayne's. Once a pileup gets going, I go through the call areas in turn, starting with either area 5 or 7, and finish at 6 (6s here are really sounding like the proverbial Californian kilowatt). By asking for the callsign *once* only, and then answering the loudest heard, turnaround is pretty quick. And it gets rid of the tail-enders once and for all. Some doubling does occur, and there is always some QRM, but the beams at the other end seem to sort things out pretty well. And, once there is a successful QSO with just *one* QRP station, other stations in the queue are that much more patient—they know that their turn will surely come. Elbow jolts are far fewer.

A couple of comments for queue jumpers. They are right at the top of my hate parade—if others can wait, so can they. If they can't, *no* QSL.

Inexperienced amateurs wishing to QSL with rare DX should note the following:

Please make sure that your QSL card has all the information needed, and that it is right. I have had cards with the time wrong by hours, or which used local, not UTC, and cards on which the date has been wrong by up to a month (I wonder what they are using for log books—mine is written up as the call is made); there are even some cards here without the name and address of the operator!

For rarer DX, postage is a major expense. I know of some DX stations who will not reply unless some form of postage is included. One IRC will get a surface mail reply from most stations; if more IRCs are needed, "George Washington" may be both cheaper and worth more at the other end. If time is available, ask your DX station. He may prefer one or the other. Of course, many DX stations have a QSL manager. The same courtesies should also be extended to him.

As regards the magazine, when the format changed (with all the emphasis on techniques and a technology that will have little short-term relevance in the South Pacific), I was initially disappointed. However, upon reflection, I say, "go to it!" This is a hobby, with frontiers that the professionals simply do not have the resources to explore. Why, that is where *we* came from in the first place! And, as for my subscription to *73*, why, when I first decided to pay out a week's wages in 1966, when I first became a subscriber, my, it was a big decision. Now, I look upon it as an investment which is still returning great dividends after all this time. In fact, my most useful resource is nearly 16 years of articles on every topic in the hobbyist's field.

David Bell 3D2DB
Suva, Fiji

1966? That's the year I visited Suva and got on the air as VR2FD (Fuddy Duddy). I was using a borrowed Heath transceiver and I had a ball. Perhaps one of these days I'll be able to stop off at Fiji again and enjoy the Kava ceremonies, update my call to 3D2FD, and work a few more of the pileups.—Wayne.

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

VHF-UHF COMMUNICATION

I've had a love affair with VHF-UHF radio that stretches back to my earliest days in this hobby. While any appropriately-licensed amateur with a few bucks can talk to the far corners of the Earth on HF, it takes skill—not just money—to work DX on 50 MHz and above.

Perhaps the reason for my fixation with the top frequencies has something to do with the way I entered ham radio. You see, unlike my fellow neophytes, I started my ham career with a Tech license. While I have nothing against either Novices or CW addicts, I've always felt more relief than accomplishment after passing a code test. Indeed, after I passed my Extra, I took all of my code cassettes and recorded music over them.

My proudest moment on VHF came on November 20, 1979. That was the day K7OFT and I (I was WB2IBE then) set the amateur distance record for a two-way A4 facsimile contact (New York City to Seattle, 2,430 miles, 50.250 MHz). Now that the FCC has opened A4 to the HF bands, I'm sure the record will soon be broken. Still, DX is child's play on HF. But experimenting on six meters and up—that's a different world.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) Increases receiver sensitivity
9) Interference type (abbr.)
10) A 6-meter activity (abbr.)
11) Not twice
12) Key maker
13) Circuit type (abbr.)
15) J-pole, for instance
16) Costa Rica prefix
17) Regret or French street
18) VHF-UHF combined antennas
20) Handle
21) Canadian rule-makers (abbr.)
22) The medium (abbr.)
23) Morse "standby"
24) Month after VHF QSO Party (abbr.)
25) A place to skip (abbr.)
27) Haiti prefix
28) Alaska prefix
30) HF rig to VHF rig

Down

1) Transmission of energy
2) Transmitter
3) Were you calling...
4) Night (abbr.)
5) After 2 down
6) Operating shot
7) Chip (abbr.)

8) Superhet and superreg
14) Old Novice prefix
19) Beam
21) Noise or connector
22) Sun
23) Hawaii prefix
26) League appointment (abbr.)
27) Top-type antenna
28) West coast city (abbr.)
29) Gate type

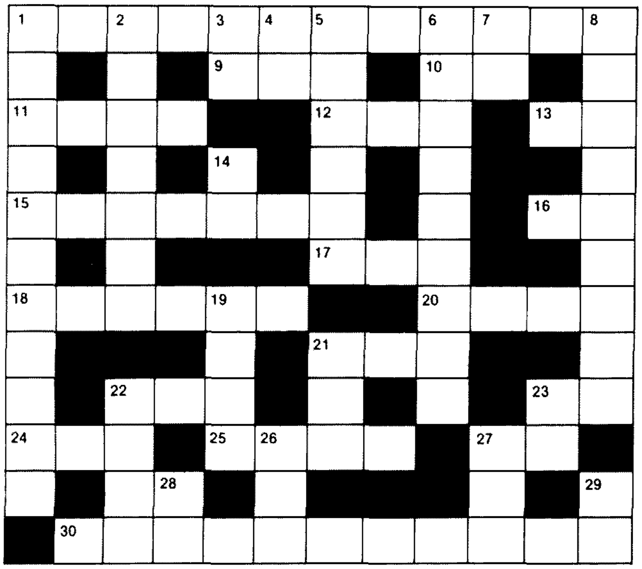


Illustration 1.

ELEMENT 2—FILL-IN

(Courtesy of Joe Reisert W1JR)

1) 6 meters: ______ to ______ MHz. The SSB calling frequency is ______ MHz.
2) 2 meters: ______ to ______ MHz. The SSB calling frequency is ______ MHz.
3) 1¼ meters: ______ to ______ MHz. The SSB/CW calling frequency is ______ MHz.
4) 70 centimeters: ______ to ______ MHz. The SSB/CW calling frequency is ______ MHz.
5) 23 centimeters: ______ to ______ MHz.
6) 13 centimeters: ______ to ______ MHz.
7) The two exclusive VHF CW bands are ______ to ______ MHz and ______ to ______ MHz.
8) The highest FCC frequency assignment is ______.
9) The first US station to work Europe on 6 meters was ______.
10) ______ popularized 144 MHz with his low-noise 417 tube converter.
11) ______, ______, ______, ______, ______, all have their calls on 432 yagis.
12) An early pioneer of EME from the W1 call area was ______.
13) The first recipients of 144- and 432-MHz WAS awards: ______, ______.
14) Name the ARRL sections in the W1 call area ______, ______, ______, ______, ______, ______, ______.
15) Name the ARRL sections in the W2 call area ______, ______, ______, ______, ______.
16) The call ______ set the all-time June multi-op contest record.
17) The lowest frequency two-way EME QSO was on ______ MHz and the highest was on ______ MHz.
18) The highest frequency where meteor-scatter QSOs have occurred is ______ MHz.
19) What mode of propagation is possible on 220 MHz, but is still unattained? ______.
20) Typical meteor-scatter QSOs rarely occur beyond ______ miles.
21) 10,000-mile-DX QSOs are possible on EME. True or false? ______.
22) Statistically speaking, the most popular frequency band and mode for VHF communication is: ______, ______.

ELEMENT 3—SCRAMBLED WORDS

Unscramble these terms relating to VHF-UHF communication:

VEAWGIDEU	LIRNDEAH	EVAWCRIMO
ISHD	PRETREEA	TTREACS
EREHPSOPOTR	ETASLTILE	KLIN
ECRNORTVE		

ELEMENT 4—MULTIPLE CHOICE

1) In which month of the year does the Leonids meteor shower occur?
   1) November
   2) July
   3) August
   4) March
2) If you put all of the VHF bands together (2 through 1¼ meters), how many total Hertz would you have?
   1) 60 MHz
   2) 60 kHz
   3) 16 MHz
   4) 13 MHz
3) In which year did we lose the 5-meter band?
   1) 1928
   2) 1941
   3) 1968
   4) Amateurs never had a 5-meter band.
4) In which year did the first US-Great Britain 6-meter QSO take place?
   1) 1934
   2) 1946
   3) 1969
   4) It's never been done.
5) Which of the following devices can be used to measure VHF frequencies?
   1) Lecher wires
   2) Grid drip-pan meter
   3) VTVM
   4) Frequency multiplier

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1—50, 54, 50.110
2—144, 148, 144.2
3—220, 225, 220.1
4—420, 450, 432.1
5—1215, 1300
6—2300, 2450
7—50, 50.1, 144, 144.1
8—300 GHz and up
9—W1HDQ
10—W2AZL
11—W1HDQ, K2RIW, W0EYE, F9FT, N6NB
12—W1FZJ
13—K0MQS, W0YZS
14—NH, ME, VT, RI, CT, EMA, WMA
15—WNY, ENY, NYC/LI, NNJ, SNJ
16—W1FC
17—50, 2304
18—432
19—Es or sporadic E
20—1500
21—True
22—2 meters, FM

Element 3:
(Reading from left to right) WAVEGUIDE, HARDLINE, MICROWAVE, DISH, REPEATER, SCATTER, TROPOSPHERE, SATELLITE, LINK, CONVERTER.

Element 4:

1—1 I can't figure out why they would name a meteor shower after a Soviet president.

2—4 A lot of real estate. So why is everybody on 2 meters?

3—2 After the war we moved to 6 meters. Some stupid thing called "television" forced the change.

4—4 No 6-meter privileges in the UK.

5—1 There may still be some old-timers using these things instead of frequency counters. Check an old theory book for an explanation of how these devices work.

SCORING

Element 1:
Twenty-five points for the completed puzzle, or one-half point for each question correctly answered.

Element 2:
One-half point for each blank filled.

Element 3:
Two and one-half points for each word unscrambled.

Element 4:
Five points for each correct answer.

How did you do?

1-20 points—Like 220 at 3 am.
21-40 points—Misdirected beam.
41-60 points—Smart as a QSO on a calling frequency.
61-80 points—Very high IQ.
81-100+ points—Ultra high IQ.

P	R	E	A	M	P	L	I	F	I	E	R
R		X		E	M	I		R	C		E
O	N	C	E			N	Y	E		L	C
P		I		K		E		Q			E
A	N	T	E	N	N	A		U		T	I
G		E				R	U	E			V
A	R	R	A	Y	S			N	A	M	E
T				A		D	O	C			R
I		S	I	G		I		Y		A	S
O	C	T		I	O	N	O		H	H	
N		A	L		V				A		O
	T	R	A	N	S	V	E	R	T	E	R

Illustration 1A.

FUN! MAILBOX

I just received my May issue of *73* and I'm pleased that so many were able to solve the DX puzzle printed in the January issue. On the other hand, I'm sorry, John, about the indignant comments you received. Obviously, the puzzle was submitted as a brain teaser and to have *FUN!*

The *really* sad part is that I have to inform you and the contestants that solution 1 is correct whereas the other two are not!

There are three pertinent time elements in the clues, namely, (1) previously worked, (2) now working, and (3) will work next.

Clue E states, "Jack, who previously worked Taiwan, will not next work Hong Kong." In effect, this clue says that Jack had just worked Taiwan but it doesn't tell who he is working now—only that he will not be working Hong Kong next. From this clue a partial sequence develops, namely, Taiwan to ???? to Hong Kong. Both solutions 2 and 3 show a sequence of Taiwan to Mongolia to Hong Kong, which is invalid. Hence solutions 2 and 3 are incorrect.

To be fair, however, I can now see that clue E might have been clearer if it had stated "...who had just previously worked Taiwan..."

Thanks for running the puzzle, John, and if any of the contestants want a copy of my solution, I'll be pleased to send it to them. An SASE would be appreciated.

Bob Young W1MXI
Belmont MA

Will we never find an end to the January DX puzzle? Here I am, getting my woolies ready for another winter, and we have yet another interpretation on that brain-twister. Personally, I think it's all a matter of semantics, and hope readers will take up Bob's offer of corresponding directly with him. As for me, I'm through with this one.—JE.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

new developments to keep us busy trying to keep up for months to come.

Being not completely unknown in the industry, I was taken behind the scenes to see some exciting new products not being shown at the show. As the publisher of four magazines in the micro field, I guess I get a bit too convinced of my visibility and am thus brought down to earth when a new firm gets into the field and I run into a group of people who have never heard of me or my magazines.

I went through this shock recently with the debuts of four DEC computers, two Wang systems, the Sony computer, and the Victor computer. More and more computers are being brought to the market by firms with virtually no knowledge of the microcomputer market. This seems like a recipe for disaster, but perhaps these firms will adapt and succeed.

The proliferation of low-cost computers is exciting. With the price of the Radio Shack Color Computer being dropped to around $300, the prices on the VIC-20 going to around $239, the Sinclair coming out via Timex at $100 (with discounts probably to around $88), the new Panasonic JR-200 at $300, the Commodore Max at around $150, and so on, there is going to be a lot of computing power available in the under $300 range. This means that there are going to be opportunities for programs, accessories, expansions, and so forth for these systems. Look for new businesses to start and soon be raking in millions. We are going to see a lot of new millionaires in the next few years.

After four hectic days of shows and four Eastern trips, it was time for a short vacation, so Sherry and I took Eastern to San Antonio for a visit with her mother in Seguin, Texas. Her father was away on a visit to my folks up in northern New Hampshire, so we missed him. We got a good night's sleep, had one of the fantastic meals Alma makes, and were on our way to the airport again. This time we went to Atlanta and then on to Ft. Lauderdale for the computer show there.

The show, held at Brower College, had not been as well publicized as one might wish, so the attendance was small. With all due respect, *Infoworld*, while a fine newspaper, is not the best bet for reaching hobbyists and people interested in computer shows. I think my talk cleaned out the exhibit hall completely, with 82 to hear me. Sherry and I

grabbed a nice lunch at the 94th Aero Squadron restaurant before the show. We enjoy that place, though our visits to Ft. Lauderdale are not all that frequent.

The talk over, we rushed back to the airport via Swenson's Ice Cream Parlor and a banana split. This time Eastern took us to Atlanta, but instead of the lounge we headed for town and the Marriott for the Atlanta Hamfestival.

The hamfest didn't seem to draw as large crowds as in many past years. I don't know if this is a reflection on the lack of growth of amateur radio, the economy, or the lack of anything really new and exciting to bring 'em in. Only about half of the exhibit booths had been sold, so most of the industry people weren't there. . . and the computer exhibits had almost completely disappeared. A couple years ago it looked as if the computer exhibits might push out the ham exhibits.

This lack of computer coverage may be a reflection of the turn in interest of the show promoters. A few years ago I worked with them to put on the heat to bring in computer exhibits and computer interested readers. I didn't hear much from them this year, so I didn't do much. Something big is needed to bring this great hamfest back to life.

I'm not fussing with the committee, for they were as cooperative as they could be for me. At the last minute, when I found I had a day between my Ft. Lauderdale talk and a trip to Colombia, Chaz arranged a spot for me to give a talk. . . at 2:00 pm Saturday, the best time. They did everything possible to make my short visit comfortable and fun.

For some reason, Sunday is the big day at Atlanta. Most hamfests only pull about 50% as much traffic on Sunday as Saturday, but Atlanta has historically pulled more on Sunday. They did again. Some of the exhibitors who had been grumbling about the sparse attendance on Saturday perked up as sales boomed on Sunday. Well perhaps "boomed" is an exaggeration. Nobody was buying much in the way of expensive equipment. . . and the flea market was very depressing.

The hotel got on my recommended list with their luncheon. They had a do-it-yourself dessert buffet for $1.95. I think this is the first time I ever beat a restaurant on a buffet. I really did a job on that buffet, starting out with apple cobbler smothered with soft serve ice cream, then going on to sundaes with cherries, strawberries, chocolate, and pineapple. I was not able to get to the baklava, the cream puffs, the chocolate eclairs, and so on. Hmmm, if we can allow a little more time between planes in Atlanta, I wonder if we might. . . ?

Saturday night in Atlanta has turned into a ritual. Chuck Martin of Tufts was exhibiting, so his crew joined us on a trip out to Aunt Fanny's Cabin where we did the best we could with fried chicken, Smithfield ham, and all the fixings. Chuck, who had driven down, went back via the Knoxville World's Fair.

On Sunday morning, Sherry and I went back to the airport and Eastern, with a stop off in Miami on the way to Baranquilia. It's not as long a trip as I thought.

Once ensconsed in the Hilton in Cartagena, I began to wonder how I might get in touch with some of the local amateurs. I'd brought a page of the Callbook with me, so I had the addresses of quite a few hams in Cartagena (Car-ta-hey-na). . . but which of them spoke English? Sherry, who knows a dozen or two words of Spanish, tried calling a few of the hams, but never managed to get beyond their housemaids. Then she got the hotel operator to make the calls for us and we were soon in touch with HK1EDM and HK1FA, Victor, the president of the local radio club.

Armando Castillo HK1EDM, a local plastic surgeon, his daughter, with Victor Yacaman HK1FA and his wife picked us up for dinner on Monday. They took the time to drive us around the old walled city and fill us in on the fascinating history of the town. It seems that Cartegena was repeatedly attacked by pirates, often being captured. Some of the pirates were a bit more than we've seen in our movies, arriving with nearly 200 ships and 23,000 troops.

We visited the radio club, where I signed in the log. They have their own club premises, complete with a service bench for repairing ham gear.

While I didn't send ahead for a license since I would be there for only two days, I did have along a Kenwood HT, so I checked out the local repeaters. I had no trouble kerchunking five different repeaters from the hotel on 146.61, 64, 94, 147.06, and 147.24. I heard at least three more, but was unable to kerchunk them. Simplex was going strong on 145.05, 24, 85. You can bet that the next time I manage a day or two in Colombia at the end of a business trip, I'll have a license awaiting me and be busy talking on the repeaters. If I can get away for a couple more days I'll include a side trip to San Andres for some skin diving.

The trip back to Baranquilla was similar to the one down, complete with the singing children and small-town food vendors. The bus was smaller and hotter. Once at the airport, everything settled into routine and in a few hours we were back in Peterborough, New Hampshire, laughing over the problems and the fun of the visit.

The amateurs in Colombia, like amateurs everywhere, are wonderful people. I've never been seriously disappointed in my travels. Of course it helps when I am able to meet hams like Rudolf, who have been reading my editorials and already know me pretty well.

Eastern managed to get most of the Braniff routes to South America, so they've removed Colombia from their special around-the-airline fare. They may be working on a new fare system which will include more of South America. In the past I've found that I could, by putting up with the Atlanta stops, get to a couple of shows cheaper than to just one. . . and then be able to include a stop or two in the Caribbean as a bonus. Sherry and I managed St. Maarten, Martinique, and other such stops this way in the past. It's worth looking into. Eastern keeps inching up the cost of their around-the-system excursion fare, so check it out the next time you have to make a trip somewhere and see if you can't throw in a side trip to Antigua at no extra cost. I've only visited two South American countries so far, so I'm watching for something special from Eastern which could get me to a few more without a lot of cost. NSD stands for Never Spend a Dollar, which is consistent with my Yankee upbringing.

RADIOAFICIONADOS

Note: if you look in the yellow pages of the phone book under Radioaficionados, you may find a list of the local radio amateurs


106 - Publicidad - Puertos Marítimos y Fluviales - Radioaficionados

PUBLICIDAD (Continuación)

CAS PUBLICIDAD
CENTRO COMERCIAL BOCAGRANDE

COMPAÑIA GENERAL DE PUBLICIDAD Y MARKETING

COMUNICAR - PUBLICIDAD
Oficina: Centro Comercial Bocagrande
TELEFONO 45 883
Apartado 4926

Centro Cr. 4ª
Nº 37 17 7º Piso
Telefonos 45 458 45 637
Gran

PUBLICISTAS

PUERTAS

PUERTOS MARITIMOS Y FLUVIALES

PUERTOS DE COLOMBIA

PUNTILLAS

QUESOS

FABRICA DE QUESO Y MANTEQUILLA REY
OFICINA:
TELEFONO: 23 146
Apartado 1299

QUIMICOS FARMACEUTICOS

EL PARAISO DEL RADIADOR

INDUSTRIAS NALRAD LTDA.
TELS. 45 465 - 41 910

puertos de colombia
TERMINAL MARITIMO Y FLUVIAL DE CARTAGENA
"Mejores Puertos para el Progreso Nacional"
CONMUTADOR: 40 280 AL 40 284
TELEFONOS DIRECTOS:

Gerencia	43 742
Reindustriales	40 291
Director Jurídico	44 131
Finanzas	40 292
Mantenimiento	45 958
Operaciones y Muelles	40 297
Auditoría Fiscal	42 619
Clínica	45 370
Residencia Gerente	40 295
Residencia Director Relaciones	47 771
Residencia Director Mantenimiento	46 483
Residencia Director Jurídico	44 472

OFICINAS: Manga Terminal
Apdo. Aéreo: 94 - Cables: "TERMARIT" - Télex: 37716

RADIOAFICIONADOS

LIGA COLOMBIANA DE RADIOAFICIONADOS

RADIO CLUB CARTAGENA DE INDIAS

RADIO CLUB DEL ATLANTICO

listed by name and call in Latin American phone books. The listing in Cartagena was most helpful.

SUCCESS

A depressing bit of news was in a recent report in the *Wall Street Journal*. Unless they rewrote the study, something I have personally known them to do...so I don't give them a lot of creditability, this showed that a high percentage of the teenagers they polled had little interest in success. All they wanted out of life was to have a home, a job, and a family.

I suppose, considering the cost of homes these days, that might seem like an outsized expectation, but I find that I am angry with the schools which are teaching the kids these meager values. Remember, if you will, that many of the people we employ to teach our children...the people who are giving them much of their values...are failures as far as coping with our economic system is concerned. It is a pity that parents have so little real choice in schools...and make this even worse by having virtually no communication with their kids. At home, the television set is on and other studies have shown that the parents will fight almost to the death to keep it on, day and night.

Without much in the way of real communication with the parents, children have to learn from television and school... neither of which is inspiring. Are there any TV shows which show successful people accomplishing things? In most of the shows I've seen, the heads of large corporations are busy ordering people killed, stealing formulas, and other skullduggery.

Our school system is set up so as to virtually guarantee failure as far as making any real money is concerned. Pity, for the more money you make the more ability you have to help move the world ahead. The less you make, the less say you have in what is going on. Yet we have our schools set up so as to provide employees for large businesses (no one has ever gotten rich as an executive in a large business...according to John Wareham in his *Secrets of a Corporate Headhunter*...a superb, if probably disturbing book). If one continues on through the educational process, one finds the goal is teaching, another proven way to stay impoverished.

With little, if any, input to the kid from the parents, I suppose it is no wonder that our kids have no enthusiasm for success. This is something which happens in early schooling, so by the time a kid might get a chance to listen to me it is too late.

This is frustrating, in a way. Here we are in the middle of the computer revolution, with opportunities on every side for youngsters to become incredibly successful, yet most of them don't want to and won't make even a slight effort to try. We've already seen more new millionaires as a result of the microcomputer in the last two or three years than we've had in any similar period in history...and this is only the beginning. We are about to enter a computer/communications explosion which will force millions on many more entrepreneurs. It's all there if you want it.

Being, for some reason, an entrepreneur, I see these opportunities opening up on every side. And I see a lack of people with the background it takes to succeed. I'm held back from getting into many more projects by lack of money for growth...and a lack of able people to follow up on the work that has to be done. Oh, we're growing at about 40% or so a year, but the opportunities are out there for ten times that in growth...if the venture capital and management were available.

Well, enough grousing about my frustrations. If I can organize a pilot model college to provide an entrepreneurial education I think our country would be able to grow faster and cope more successfully with the Japanese. I don't think we will ever do it with big corporations and the type of people they generate.

EMERGENCIES

Speaking of frustrations, I'm still looking for articles on advanced emergency communications systems which amateur radio could pioneer. Not only does amateur radio need the boost such new systems would provide, but our country needs the safety which such systems could provide. Right now, if the bombs should drop, we'd be in one hell of a fix. A recent disaster novel, *Satan's Hammer*, spells out many of the problems we would face should a major disaster occur. Unfortunately, the authors of the book were unfamiliar with amateur radio, a service which will obviously be of key importance in any calamity.

It is a crime that amateur radio has managed to keep the traffic nets using CW for the last 30 years. When John Williams W2BFD and others showed the simplicity and effectiveness of RTTY back in 1948, it was time to make the change from Morse code to RTTY at 60 or 100 words per minute. Now, with a computer within the reach of anyone (Sinclair, $100), what on Earth are we thinking of trying to send emergency messages with a hand key at ten or twenty words per minute? What do I have to do to get some action, start an Amateur Radioteletype Repeater League to bring us into the last half of the century? Yes, I know that virtually to a man you are about my age...which is sixty this year...and that you are tired and don't want to try anything new. Well, dammit, stock up on All-Bran and prunes and let's get this old ark a moverin. I want to see some sign of experimentation, even if we have to develop the action in the geriatric set.

In case you have managed to avoid the news programs on television, more and more countries are going atomic. This means that one of these days a little war, such as our recent conflicts in Lebanon, the Falklands, and so on, could escalate into that projected loss of 140 million Americans. Yep, there goes old gloom and doom Wayne again...and I admit it this time. Sure, I agree with you that such a thing is so terrible that it is absolutely impossible. But I don't believe that any more than you do.

We both know that it is highly unlikely...but the possibility has to be reckoned with. Now if amateur radio could come into the 80s and get some emergency relay systems working... automatic relays...with high speed digital communications...we just might have something left should all hell break loose. If we are going to depend on CB for post-atomic communications, we are not going to have a workable government.

You probably don't have the guts to bring this up at a club meeting and get things started. I don't blame you. No, it's better to get mad at me for bringing it up and do be sure the next time you see me to assure me that you don't always agree with everything I write.

IONIZED!

The article on negative ions in the July *73* (page 52) left out a very important piece of information that you really should have before you start pouring ions around your house. There's a little side effect of these damned ion generators which they don't tell you about...one which can cost you a bundle.

There has been a mystique about negative ions for years. All sorts of claims have been made for them at various times...such as that they help you to think better, to feel better, to heal faster, and so on. Articles have pointed to positive ions as bringing on depression and even suicides.

With the government taking a dim view of sales literature promising cures for things where proof is lacking, the brochures for negative ion generators are a marvel of hyperbole without anything really being promised. These ads do not promote confidence in the product.

Yet it seems as if there must be *something* there. I can't help but notice that virtually all of my really brilliant ideas come while I am taking a shower. If I sit in a tub of water nothing much happens. I probably should have a shower attached to my office and pop in and out a dozen times a day. I've read that this is not an unusual occurrence and that it is thought to be the knocking off of positive ions by the shower water which is responsible. This is supposed to build up the negative ions, allowing the brain to function better.

Now, as any of my great army of detractors will vouch, anything which will help me think better should be pursued. So it was only a matter of time until I got sucked in and bought one of those negative ion generators for my office. It was a little one...one of those small black ball types I'm sure you've seen advertised. Mail-order item. Well, it arrived and I plugged it in and put it above my desk and awaited flashes of brilliance. Nothing happened.

These gadgets are being sold as smoke-clearing devices. I've seen demonstrations of how they precipitate smoke out of the air almost instantly. Well, that's great for some offices, but I don't smoke. I don't hire anyone who smokes. I don't let anyone smoke in the building, much less my office, so *that* function of the generator isn't very helpful... but it does tie in with the disastrous side effect.

A couple months ago I got an ad in the mail for a more powerful ion generator. Hmmm, perhaps that was the trouble, not enough ions. So I sent for this powerhouse ion generator and waited with hopes of being able to keep brilliant thoughts perking day and night.

The contraption arrived. It wasn't a lot larger than the black bomb sitting on the bookshelf over my head. *This* is a powerhouse generator? Oh, well, I put it on the shelf and plugged it in and waited for genius to strike. And *I* waited.

There must be something wrong with the idea. Here I was awash in negative ions and I felt tired and needed to lie down for a nap. Phooey. So I reached down to unplug the new generator and got zapped. That sucker had zillions of volts jumping out of the power plug... I couldn't get near it. Did I have the plug in backwards? I got some insulated foam and changed the plug around. Nope, still the same...hot. That's dangerous! There must be 100,000 volts jumping around that wall socket. You know, it's mighty difficult to pull a power plug when you know it is going to give you a dandy shock, even with insulation. I sent the gadget back to the mail-order house and got a refund.

Okay, now the real kicker. After a year of sitting under my black bomb awaiting benefits, I moved some of the boxes of magazines which were on the shelf to another room. For a good ten feet around the generator, every book or box on the shelf had an outline around it printed permanently on the wall. A picture on the wall six feet from the generator was nicely outlined in black. It was as if I had sprayed the wall with dark grey. That damned generator had attracted the dust in the air to the walls of the room...and the books, boxes, pictures, and so on. I got a hundred years worth of dust coating my walls in about one year! The office walls are a disaster. Even the ceiling at that end of the room is a much darker grey. The whole *room* will have to be painted.

I thought you might like to know before you get too enthused over the ion generator in the July issue.

HAM PUBLICATIONS

The virtual disappearance of *Ham Radio* magazine from hamfests and conventions has reinforced rumors that publisher Tenney would like to retire. There was some serious talk of that a few months ago, but apparently the chap interested in taking it over thought better of the idea after looking into the economics.

Tenney has been talking about retirement and his recent folding of *Ham Horizons* and getting rid of *Ham Radio Report* would indicate that he is winding down his publishing business. With the loss of editor Fisk, *HR* seems to have no one on the staff qualified to select and edit the more technical articles.

Since magazine publishers do have to take care of their subscribers when they fold their magazines, the usual move is to turn to a similar publication and arrange for them to fulfill the obligation. This is an expensive matter, but hopes of subsequent renewals and thus an eventual recouping of the investment often prevail.

With *HR* reaching the lowest point in advertising in ten years this spring, the losses must be considerable. However, should *HR* fold, you may be sure that ham high-tech articles will not disappear. We're preparing to open a section in *73* on this so that we can provide serious engineering builders the projects they like. We *do* have good technical brains on tap.

The way we keep score in the publishing business is by counting pages of advertising. For instance, to put things into perspective, in May, *73* had 93 pages of ads, *QST* had 91 pages, *CQ* had 58 pages, and *HR* had 37 pages. That about tells the story. With the break-even point for most magazines being at around 45% advertising these days, when one is only running about 37%, like *HR*, the chances are that money is being lost and something is going to have to change. They've been under 45% for a year, so it's probable that the losses have been mounting. Of course if circulation is kept small, it *is* possible to get by with fewer ads, so that could be their stratagem.

The main problem in the whole ham field is one of lack of growth. This has kept the sale of ham gear down and that, in turn, has limited funds for advertising. Advertisers tend to cut back and advertise only where they know they are getting the most sales, which puts the pinch on specialty publications such as *HR*. Tests often show that advertisers are able to do about the same in sales with or without ads in anything but *73* and *QST*. When sales are brisk and profits large, firms can afford to run ads in smaller magazines as a way of helping them. But when the bottom line starts turning red, these extravagances are reconsidered.

To perhaps put things into a better perspective, let's look at how advertising is going to *73*, *QST*, and *HR* for the first six months of 1982 vs. the same period in 1981.

Pages of ads

	1981	1982
73	426	534
QST	571	556
HR	301	212

Thus, in comparable periods, we see *73* advertising up over 25%, *QST* down about 2½%, and *HR* down 30%! Obviously something is happening.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

EUROPEAN DX CONTEST—PHONE

Starts: 0000 GMT September 11
Ends: 2400 GMT September 12

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operation out of the 48-hour period are permitted for single-operator stations. The 12 hours of non-operation may be taken in one but not more than three periods at any time during the contest. Operating classes include: single operator, allband and multi-operator, single transmitter. Multi-operator, single-transmitter stations are allowed to change band only one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 through 28 MHz. A contest QSO can be established only between a non-European and a European station. Each station can be worked only once per band.

EXCHANGE:

Exchange the usual five-digit number consisting of RS and progressive QSO number starting with 001.

SCORING:

Each QSO counts 1 point. Each QTC (given or received) counts 1 point. The multiplier for non-European stations is determined by the number of European countries worked on each band. Europeans will use the last ARRL countries list. In addition, each call area in the following countries will be considered a multiplier: JA, PY, VE, VO, VK, W/K, ZL, ZS, and UA9/UA0. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. The final score is the total QSO points plus QTC points multiplied by the sum total of multipliers.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to a European station. It can be sent only from a non-European station to a European station, the general idea being that after a number of European stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1-point credit can be claimed for each station reported.

CALENDAR

Sep 11-12	ARRL VHF QSO Party
Sep 11-12	European DX Contest—Phone
Sep 11-12	Cray Valley RS SWL Contest
Sep 18-19	New Mexico QSO Party
Sep 18-19	CAN-AM Contest—Phone
Sep 18-19	College Scrimmage
Sep 18-20	Washington State QSO Party
Sep 25-26	Maine QSO Party
Sep 25-26	CAN-AM Contest—CW
Sep 25-27	Massachusetts QSO Party
Oct 2-3	California QSO Party
Oct 16-17	ARCI QRP CW QSO Party
Oct 16-17	Pennsylvania QSO Party
Oct 16-17	BSA Jamboree-On-The-Air
Oct 23-24	Maryland-District of Columbia QSO Party
Nov 6-7	ARRL Sweepstakes—CW
Nov 13-14	European DX Contest—RTTY
Nov 20-21	ARRL Sweepstakes—Phone
Dec 4-5	ARRL 160-Meter Contest
Dec 11-12	ARRL 10-Meter Contest
Dec 19	CARF Canada Contest
Jan 8	*73 Magazine* 40-Meter World SSB Championship
Jan 9	*73 Magazine* 80-Meter World SSB Championship
Jan 15-16	*73 Magazine* 160-Meter World SSB Championship

A QTC contains the time, call, and QSO number of the station being reported, i.e., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. Only a maximum of 10 QTCs to a station are permitted. You may work the same station several times to complete this quota but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported. Europeans may keep the list of the received QTCs on a separate sheet if they clearly indicate the station who sent the QTCs.

AWARDS:

Certificates to the highest scorer in the each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given to stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirement for a certificate or a trophy is 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the Contest Committee are final. It is suggested that the log sheets of the DARC or equivalent be used. Send a large SASE to get the wanted number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than October 15th to: DARC DX Awards, PO Box 1328, D-895 Kaufbeuren, Germany.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HB0, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1346, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, and 9H1.

BIARC BULLETIN

NEWSLETTER OF THE MONTH

This month's newsletter winner, the *BIARC Bulletin*, is chock-full of useful information. Published by the Big Island Amateur Radio Club, Hilo HI, the newsletter has an activity calendar that lists local, national, and international ham radio events, a directory of nets and bulletins, and even reminders for club members whose licenses are about to expire. The *BIARC Bulletin* also offers a special Hawaiian flavor, making it interesting to read even if you are not a member. Great job, BIARC, and great job, Editor Dean Manley KH6B!

CRAY VALLEY RS SWL CONTEST

Starts: 1800 GMT September 11
Ends: 1800 GMT September 12

Up to 18 hours of logging may be done during the contest period with a rest period clearly shown. Multi-operator stations may log during the entire contest. The contest is open to anyone in the world, and there will be two sections, phone and CW, each with two categories: single operator and multi-operator. The second category is open to two or more listeners or to clubs and more than one receiver can be used. The 1.8-, 3.5-, 7-, 14-, 21-, and 28-MHz bands may all be used.

Scores should be compiled as follows: one point for each station heard multiplied by the number of different countries heard on each band. A list of countries heard must be furnished and a separate log must be submitted for each band. Illegible logs will not be accepted. The call areas of the USA, Canada, and Australia will each count as a separate country. All other countries will be determined by the official RSGB Countries List. No CQ or QRZ or similar call will be allowed to count for points. If points are claimed for both sides of a QSO, the callsign of each must appear in the station-heard column.

Log sheets are available from Owen Cross G4DFI, 28 Garden Avenue, Bexleyheath, Kent DA7 4LF, England, if you include an SAE and sufficient return postage. If is desirable that entrants use official log sheets, but entries on homemade log sheets will be accepted if the following information is given: date, time, band station heard, station being worked, report at SWL's QTH. Points may be claimed only for stations actually heard and callsigns must be shown in full. Entries should be sent to the Contest Manager, G4DFI, at the above address, to arrive no later than November 1st. Certificates of merit will be awarded at the discretion of the board of the Cray Valley RS and its decision will be final.

WASHINGTON STATE QSO PARTY

0100 to 0700 GMT September 18
1300 GMT September 18 to 0700 GMT September 19
1300 GMT September 19 to 0100 GMT September 20

The seventeenth annual contest sponsored by the Boeing Employees' Amateur Radio Society (BEARS) is divided into three operating periods as shown. All amateurs are invited to participate. Use all bands and modes, but no CW QSOs are allowed in the phone bands. Stations may be worked once on each band and mode for contact points and more than once each band/mode if they are additional multipliers.

EXCHANGE:

QSO number, RS(T), and state, province, country, or Washington county.

FREQUENCIES:

Phone—1815, 3925, 7260, 14280, 21380, 28580; CW—1805, 3560, 7060, 14060, 21060, 28160; Novice—3725, 7125, 21150, 28160.

SCORING:

Washington stations score 2 points for each phone contact and 3 points for each CW contact, including contacts with other Washington stations. Multiply QSO points by the total number of different states, Canadian provinces, and other foreign countries worked.

All others score 2 points for each phone contact and 3 points for each CW contact with a Washington station. Multiply QSO points by the total number of different Washington counties worked (39 maximum). There will be an extra multiplier of one for each group of 8 contacts with the same Washington county for all non-Washington stations.

AWARDS:

Certificates will be awarded to the highest scoring station (both single- and multi-operator) in each state, Canadian province, foreign country, and Wash-

ington county. Additional certificates may be issued at the discretion of the Contest Committee. Worked Five BEARS Awards also are available to anyone working 5 club members before, during, or after the QSO party (unless previously issued). All QSO Party entries will be screened by the Contest Committee for possible Worked Five BEARS Awards. Worked Three BEAR Cubs Awards are also available for working 3 Novice members.

ENTRIES:

Logs must show dates/times in GMT, stations worked, exchanges sent and received, bands and modes used, and scores claimed. Include a dupe sheet for entries with more than 200 QSOs. Each entry must include a signed statement that the decision of the Contest Committee will be accepted as final. No logs can be returned. Results of the QSO Party will be mailed to all entrants and an SASE is *not* required. Log sheets and summary sheets must be postmarked no later than October 20th and sent to: Boeing Employees' Amateur Radio Society, c/o Contest Committee, Willis D. Propst K7RS, 18415 38th Avenue South, Seattle WA 98188.

RESULTS

1982 VIRGINIA STATE QSO PARTY RESULTS

Top Score:		**Top In State:**	
W4VP/4	70,416	**W4VP/4**	70,416
Top Out Of State:		**Top Mobile:**	
AE3Y	10,400	**KZ4K**	6,824

State Results	**Call**	**Points**
Arizona	AK7J	16
Connecticut	K1BV	735
Delaware	AE3H	90
Florida	W8BZY/4	238
Georgia	K4VT	2,346
Idaho	W7GHT	320
Iowa	WB0UCP	336
Kansas	N0CLV	289
Louisiana	W5WG	2,294
Maryland	AE3Y	10,400
Massachusetts	W1AQE	1,440
Michigan	W8YL	968
New Jersey	W2XQ	4,465
New York	W2MTA	5,671
North Carolina	K4JEX	1,530
Pennsylvania	W3ZE	1,650
Rhode Island	K1GTI	460
South Carolina	K4BZD	1,305
Texas	W5PWG	1,802
Washington	WA7JUJ	20
West Virginia	WA8KAN	748
Wisconsin	K9GDF	100

Virginia Results	**Call**	**Points**
Accomack	KC4HN	3,280
Albemarle	WB3HUP/m	156
Alleghany	WB3HUP/m	2
Amelia	KZ4K/m	170
Amherst	WB3HUP/m	143
Bath	WA4NVD	20,303
Bland	WB3HUP/m	8
Botetourt	WB3HUP/m	99
Buckingham	KZ4K/m	476
Campbell	WB3HUP/m	288
Carroll	WB3HUP/m	770
Charles City	K4JST	384
Chesterfield	N4BLV	2,627
Clarke	N4MM	36
Culpepper	KZ4K/m	80
Cumberland	KZ4K/m	396
Dinwiddie	KZ4K/m	672
Essex	KA3DTE	1,908
Fairfax	W4NM	7,579
Fauquier	KZ4K/m	195
Floyd	WB3HUP/m	88
Fluvanna	KZ4K/m	399
Franklin	WB3HUP/m	192
Frederick	N3OS/4	1,628
Giles	WB3HUP/m	42
Gloucester	KZ4K/m	16
Grayson	WB3HUP/m	520
Henrico	WB4URW	13,542
Henry	WB3HUP/m	9
Highland	W4VP/4	70,416
King George	KZ4K/m	49
King and Queen	KZ4K/m	35
King William	KZ4K/m	42
Lancaster	KZ4K/m	381
Loudoun	WA4NTP	17,280
Madison	KZ4K/m	108
Middlesex	KZ4K/m	475
Montgomery	WB3HUP/m	42
Nelson	WB3HUP/m	90
New Kent	KZ4K/m	198
Northampton	KA4KOZ	8,586
Northumberland	KZ4K/m	110
Nottoway	KZ4K/m	135
Orange	KZ4K/m	110
Page	WB3HUP/m	35
Patrick	WB3HUP/m	236
Pittsylvania	WB3HUP/m	132
Portsmouth	W4POX	42,230
Prince Edward	KZ4K/m	429
Prince George	KZ4K/m	240
Pulaski	KX4V	21,000
Richmond	KZ4K/m	378
Roanoke	WB3HUP/m	20
Rockingham	WB3HUP/m	9
Shenandoah	WB3HUP/m	154
Smythe	KC4IG	2,470
Spotsylvania	KZ4K/m	121
Stafford	WD4KQJ	2,304
Surry	K4JST	400
Sussex	K4JST	168
Warren	K4OD	6,204
Washington	WB3HUP/m	210
Westmoreland	KZ4K/m	999
Wythe	WB3HUP/m	182

CAN-AM CONTEST

Starts: Phone—1800 GMT September 18
CW—1800 GMT September 25
Ends: Phone—1800 GMT September 19
CW—1800 GMT September 26

Sponsored by the Ontario Contest Club and Canadian DX Association to increase the friendship among Canadian and American amateurs and to provide a means of measuring the performance of operating skills and equipment. Categories of competition: single operator—allband, single band and QRP, stations operated by the station licensee; multi-operator, single transmitter—stations operated by more than one operator, or single operator other than the licensee, or club stations; and club competition. Multi-operator stations can operate full 24-hour period, single operator stations can operate maximum 20 hours with one or two rest periods totaling a minimum of four hours which must be clearly marked in the log. Any further rest periods do not need to be logged. For QRP operation, a maximum of 10 Watts input is allowed during the contest.

FREQUENCIES:

All SW bands 1.8 through 28 MHz are permitted. US General portion of the bands is recommended for use.

EXCHANGE:

Signal report: use RS on phone and RST on CW, plus sequential QSO number starting with 001, plus multiplier area (MX) abbreviation, in that order, i.e., 59001CT, 599021NY. Multiplier area abbreviation is the usual two-letter postal abbreviation for 50 US states, CN for Caribbean (KC4, KG4, KP1, KP2, KP4, KS4, KV4 and their A- and W- prefix equivalents), PC for Pacific (rest of US possessions and Antarctica). Canadians will use: NF for VO1, VO2; NB for VE1 New Brunswick; NS for Nova Scotia; PE for Prince Edward Isl.; SI for Sable and St. Paul Isl.; PQ for VE2; ON for VE3; MB for VE4; SK for VE5; AT for VE6; BC for VE7; NW for VE8 NWT; YU for VY1 Yukon.

SCORING:

The final score is the result of the total QSO points from all bands, multiplied by the sum of the multipliers from all bands. Phone and CW sections of the contest are considered separate contests. However, combined score for phone and CW will be used for overall competition. Combined score will be calculated by the contest committee as a result of the addition of phone and CW scores. Points: American to American, and Canadian to Canadian QSOs count for 2 points; American to Canadian and vice versa count for 3 points. The same station can be contacted once on each band and mode. Stations operating from outside of their own call area must sign slash and the area they are operating from, i.e., W6AM/7, NP4A/W4, W7RM/KH6, KH0AH/W6. Multipliers: 50 US states, 2 US possessions (Caribbean, Pacific); 10 Canadian provinces, 2 territories (NWT, YU), 1 islands (Sable, St. Paul). Total of 65 multipliers per band; maximum possible on all 6 bands is 390.

AWARDS:

Handsome first-place certificates will be awarded in each

multiplier area on both modes in single-operator category. Top five multi-operator stations in each country will receive certificates for high combined phone and CW scores. All scores will be published in CQ. Trophies and plaques will be awarded to the Canadian Champion and American Champion in four categories: single operator, combined, single operator, phone, single operator, CW, and multi-operator, combined.

The Club Competition Championship will be awarded to the club having highest score as a result of addition of 5 best scores on phone and 5 best scores on CW made by its members. A club officer must submit the summary showing the callsigns and scores. Each station is eligible for one trophy only. In a case where one station qualifies for another trophy, the less-significant trophy goes to the next eligible station.

Free one-year subscription to *Long Skip*, the CANAD-X bulletin, will be awarded to the top 5 US stations.

ENTRIES:

All times must be kept in GMT. Indicate multipliers the first time only on each band. Log must be checked for duplicate contacts, correct QSO points, and multipliers. Do not use separate logs for each band. Rest periods must be clearly marked in the log. Each entry consists of: log sheets, summary sheet showing all scoring information, category of competition, operator's name and callsign, address of the station, and signed declaration. Entries with over 200 QSOs must include check sheets for each band. Official logs, check sheets and summary sheets with multiplier tables area available from the Contest Chairman; a large SASE with Canadian stamps (or US stamps not glued to the envelope) will bring you the samples. Contestants are encouraged to use them; they greatly help with the processing of the entries. Send your log regardless of your score total.

Any band can be selected for the single-band category. All single-band entries will be judged in one category. It is up to the contestant to select the one that could bring him the highest point score for his particular situation.

Violation of national amateur radio regulations or rules of the contest, unsportsmanlike conduct, taking credit for excessive duplicate contacts, or unverifiable QSOs or multipliers will be deemed sufficient cause for disqualification. Incorrectly logged calls will be counted as unverifiable contacts. Actions and decisions of the CAN-AM Contest Committee are official and final.

All entries must be postmarked not later than 30 days after the contest and mailed to: CAN-AM Contest Chairman, VE3BMV, Box 65, Don Mills, Ontario, Canada M3C 2R6.

COLLEGE SCRIMMAGE

Starts: 0200 GMT September 18
Ends: 0400 GMT September 19

The idea of this contest is to put long-lost alumni in touch with their alma mater. Entry classes include alumni and college stations (one transmitter only). Exchange name of college, junior college, or university you last attended and the last year you graduated or will graduate. Club stations substitute "amateur radio club" for number. Non-collegians substitute "high school" for college name. Stations may be worked once per band on SSB only. Multiply total QSOs times number of different colleges, junior colleges, and universities worked. Logs should be sent to Penn State ARC, K3CR, 202 Engineering Unit E, University Park PA 16802. Please include an SASE for results.

NEW MEXICO QSO PARTY

Starts: 1800 GMT September 18
Ends: 2100 GMT September 19

Sponsored by the Albuquerque DX Association. Each station may be worked once on each band and each mode.

EXCHANGE:

RS(T); QSO number starting with 001; and state, province, DX country, or NM county.

SCORING:

Count 2 points for each phone/SSB QSO and 3 points for each CW QSO. NM stations multiply total QSO points by total number of states, provinces, and DX countries worked. All others, multiply total QSO points by the total number of NM counties worked each band, each mode.

AWARDS:

Plaques will be presented to the top score from outside NM and the highest NM single operator and portable. Certificates awarded top scorers from each state, province, and DX country. Certificates will also be awarded to each station submitting a score of more than 100 total points.

ENTRIES:

Entries must be postmarked no later than October 15th and addressed to: K5QQ, 1005 Morina Court NE, Albuquerque NM 87112. Include an SASE for complete results.

1982 MAINE QSO PARTY

Starts: 2300Z September 25
Ends: 2359Z September 26

The Maine QSO Party is sponsored by the Portland Amateur Wireless Association. Exchange signal report, serial number, and QTH (county for Maine stations; state, province, or country for others). Stations may be worked once on CW and once on phone for each band. Count three points per QSO and multiply by number of Maine counties worked for final score. (Maine stations multiply by Maine counties, states, provinces, and countries.) Suggested frequencies: CW—1805 and 60 kHz up from low end of band; phone—1815, 3930, 7280, 14280, 21380, 28580 kHz; Novice—3720, 7120, 21120, 28120.

Certificates will be awarded to top scorers in each state, province, country, or Maine county. Mail entries by December 1st to PAWA, Box 1605, Portland ME 04104. Applications for the Worked All Maine Counties Award may go to the same address.

MASSACHUSETTS QSO PARTY

Starts: 1600 GMT September 25
Ends: 0200 GMT September 27

Sponsored by the Greater New Bedford Contesters. A station may be worked once per band. Phone and CW are separate bands. No crossband or repeater contacts permitted. Mobiles and portables may be counted as new contacts each time a county change takes place.

EXCHANGE:

RS(T) and state, province, or Massachusetts county.

FREQUENCIES:

Phone—1820, 3960, 7260, 14290, 21380, 28590, 50.110; CW—1810, 3560, 7060, 7120, 14060, 21060, 21120, 28060, 28120. Use of FM simplex is encouraged. Remember to use CW in CW bands only.

SCORING:

All stations count 2 points for each completed SSB exchange and 4 points for each CW exchange. Massachusetts stations multiply QSO points by total number of states, provinces, and Massachusetts counties worked. DX stations worked only count for QSO points. Outside Massachusetts, multiply QSO points times total number of Massachusetts counties worked. As a bonus, add 100 points to the total score for each sponsor worked (KA1GG, N1AVA, K1KJT). Note that they can only be worked once for bonus points.

AWARDS:

Certificates will be awarded to first through third place winners in each Massachusetts county as well as each state. Two special awards will be given out for the radio club with the highest aggregate score in Massachusetts (min. of 3 logs) and to the Massachusetts station submitting the all-time highest number of QSOs. The current record is held by K1GSK (1483 QSOs in the 1979 contest). Additionally, a certificate will be given stations working all three sponsors.

ENTRIES:

Logging must include date/time, band, mode, callsign, state and province worked, and exchange RS(T). Submit separate summary sheet along with logs. Summary sheet information should include your name, call, mailing address, club affiliation for aggregate score, total QSO points, multipliers claimed, and total score. Deadline for mailing is October 31. For awards and results, send $.50 postage (no envelope) to Ed Peters K1KJT, 29 Greenbrier Drive, New Bedford MA 02745.

SATELLITES

Amateur Satellite Reference Orbits

	OSCAR 8		RS-5		RS-6		RS-7		RS-8		
Date	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	Date
Sep 1	0055	88	0135	225	0146	230	0053	216	0026	206	1
2	0059	89	0130	225	0131	228	0043	215	0023	207	2
3	0103	90	0124	225	0115	226	0034	214	0020	208	3
4	0108	91	0119	226	0100	223	0024	213	0017	209	4
5	0112	92	0114	226	0044	221	0014	212	0014	209	5
6	0117	94	0108	226	0029	219	0005	211	0012	210	6
7	0121	95	0103	226	0014	216	0154	240	0009	211	7
8	0125	96	0058	226	0157	244	0145	239	0006	212	8
9	0130	97	0052	226	0141	241	0135	238	0003	213	9
10	0134	98	0047	227	0126	239	0125	238	0000	213	10
11	0139	99	0041	227	0111	237	0116	237	0157	244	11
12	0000	75	0036	227	0055	234	0106	236	0154	245	12
13	0004	76	0031	227	0040	232	0056	235	0152	246	13
14	0009	77	0025	227	0025	230	0047	234	0149	247	14
15	0013	78	0020	228	0009	227	0037	233	0146	248	15
16	0017	79	0015	228	0152	255	0027	232	0143	248	16
17	0022	81	0009	228	0137	253	0018	231	0140	249	17
18	0026	82	0004	228	0122	250	0008	230	0138	250	18
19	0031	83	0158	258	0106	248	0158	259	0135	251	19
20	0035	84	0153	259	0051	246	0148	259	0132	252	20
21	0039	85	0148	259	0035	243	0138	258	0129	252	21
22	0044	86	0142	259	0020	241	0129	257	0126	253	22
23	0048	87	0137	259	0005	239	0119	256	0123	254	23
24	0052	89	0132	259	0148	266	0110	255	0121	255	24
25	0057	90	0126	260	0133	264	0100	254	0118	256	25
26	0101	91	0121	260	0117	261	0050	253	0115	257	26
27	0106	92	0116	260	0102	259	0041	252	0112	257	27
28	0110	93	0110	260	0046	257	0031	251	0109	258	28
29	0114	94	0105	260	0031	254	0021	251	0107	259	29
30	0119	96	0100	260	0016	252	0012	250	0104	260	30
Oct 1	0123	97	0054	261	0000	250	0002	249	0101	261	1
2	0128	98	0049	261	0144	277	0152	278	0058	261	2
3	0132	99	0043	261	0128	275	0142	277	0055	262	3
4	0136	100	0038	261	0113	273	0132	276	0052	263	4
5	0141	101	0033	261	0057	270	0123	275	0050	264	5
6	0002	77	0027	262	0042	268	0113	274	0047	265	6
7	0006	78	0022	262	0027	266	0103	273	0044	266	7
8	0011	79	0017	262	0011	263	0054	273	0041	266	8
9	0015	80	0011	262	0155	291	0044	272	0038	267	9
10	0020	81	0006	262	0139	288	0034	271	0036	268	10
11	0024	83	0001	263	0124	286	0025	270	0033	269	11
12	0028	84	0155	293	0108	284	0015	269	0030	270	12
13	0033	85	0150	293	0053	281	0006	268	0027	270	13
14	0037	86	0144	293	0038	279	0155	297	0024	271	14
15	0042	87	0139	293	0022	277	0145	296	0021	272	15

ISKRA II

By the time you read this, the ISKRA II satellite placed into orbit by cosmonauts aboard the Salyut VII space station probably will have reentered the atmosphere and met its fiery fate. The projected lifetime of ISKRA II was only six weeks from the time of its launch on May 17.

ISKRA II was unique in being the first amateur satellite to carry an HF-to-HF transponder. It received signals on 15 meters and retransmitted them on 10 meters.

FUN WITH RS TELEMETRY

With rare exceptions, a satellite orbiting the Earth is beyond the reach of direct human observation. We can't see it, except perhaps as a bright dot in the night sky. If it misbehaves, we can't put it on the test bench to determine what ails it. In fact, the only way we have any idea of the condition of an orbiting satellite is by means of the telemetry data it constantly beams to Earth.

In the excitement over the communications opportunities offered by the six RS satellites launched last December by the Soviet Union, the interesting telemetry beacons of these spacecraft have largely been overlooked. Monitoring these beacons can be an interesting activity that does not require any special equipment. You need only the ability to receive signals at the high end of the 10-meter band.

Satellite	Beacon Frequencies (MHz)
RS3	29.321, 29.401
RS4	29.360, 29.403
RS5	29.331, 29.452
RS6	29.411, 29.453
RS7	29.341, 29.501
RS8	29.461, 29.502

Table 1. RS beacon frequencies.

The RS satellites send their telemetry in Morse code at 15-25 words per minute on the beacon frequencies shown in Table 1. Each frame of telemetry consists of seven items of information, and consecutive frames are separated by the name of the satellite. Thus, a telemetry frame from RS3 might read: RS3 K00 D12 O72 G00 U21 S79 W90. The letter prefix designates the parameter being measured, while the two-digit number represents the measured value. Often, the number must be inserted into a simple equation to translate the measurement into standard units.

A given satellite may send up to 28 different telemetry items, organized into 4 frames, before it repeats the entire sequence. Most items have a two- instead of one-letter prefix ahead of the number. Two-letter items with the same first letter are always sent as part of the same frame.

Table 2 contains a list of the telemetry prefixes so far monitored from the RS satellites, along with equations and other information.

By interpreting the telemetry data, you can learn a great deal about the environment aboard the RS satellites. It's one way to take an active part in the amateur space program even if you're not equipped for two-way satellite communications. Shortwave listeners can participate, too. Give it a try!

Prefix	Interpretation
K	0.2 × N = output power of transponder in mW
D	N × 0.2 = voltage of main power source
O	20 × (100 − N) = charge current in mA
G	telemetry baseline; should be zero (00)
U	gas pressure of sealed system; equation unknown
S	N = temp. of voltage regulator (Celsius)
W	N = temp. of transmitter cooling fins (Celsius)
IK or SK	same as K
ID or SD	telemetry baseline; should be zero (00)
IO or SO	0.2 × N = output power of beacon in mW
IG or SG	when N = 10 ± 1, a 10-dB attenuator is in line with main receiver front end
IU or SU	0.1 × (N − 10) = S-meter reading of 1st receiver
IS or SS	same as above for "robot" receiver
IW or SW	same as above for 2nd receiver
NK or RK	same as K
AK or UK	same as K
AD or UD	0.1 × N = voltage of transponder 9-volt line
AO or UO	" = voltage of transponder 7.5-volt line
AG or UG	" = voltage at first 9-volt stabilizer
AU or UU	" = voltage at first 7.5-volt stabilizer
AS or US	" = voltage at second 9-volt stabilizer
AW or UW	" = voltage at second 7.5-volt stabilizer
MK or WK	same as K
MD or WD	N = # of QSOs made by robot (occasionally reset to zero by ground controllers)
MO or WO	N × 0.1 = power consumption of heating system in Watts
MG or WG	N × 20 = input power of robot transmitter in mW
MU or WU	N × 20 = input power of service channel in mW
MS or WS	when N = 10 ± 1, a 10-dB attenuator is in line with the robot receiver front end
MW or WW	when N = 10 ± 1, a 10-dB attenuator is in line with the service receiver front end

Table 2. RS telemetry channel prefixes and their meanings. N is the two-digit number sent after the prefix. Where two prefixes are given, the first is used when the transponder aboard the satellite is inactive; the second is used when the transponder is active. The definitions of other prefixes are not yet known.

CORRECTIONS

"Coherent CW for VHF," which appeared in the July, 1982, issue, was based on a paper given at the 27th Annual VHF Conference, Western Michigan University, Kalamazoo MI, on Oct. 17, 1981.

Tim Daniel N8RK
***73 Magazine* Staff**

Following the publication of "The Very, Very Best CW Filter?" (*73 Magazine*, July, '82), some builders have written me to tell of oscillation in the output of this filter. This is probably due to an "induced" feedback to the input of the very sensitive op amp used in the circuit.

Rather than rearrange the components, it is easiest to control this oscillation by putting a small amount of positive bias on the input. Connect pin 2 of the LM324 to the positive voltage through a resistor of about 200k Ohms. The exact size of the resistor is best determined by experimentation. If the resistor is too small, the sensitivity of the unit will suffer; if the resistance is too large, some oscillation may remain.

Jim Hyde WB4TYL
Waycross GA

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EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7	14	14A	21	21A	21A	21A	21
AUSTRALIA	21	14	14	7B	7B	7B	7B	14B	14B	14	21	21A
CANAL ZONE	21	14	14	14	7	7	14	21	21	21A	21A	21A
ENGLAND	7A	7	7	7	7	7A	14	21	21	21	14	14
HAWAII	21	14	7	7	7	7	7	7	14	21	21	21
INDIA	14	14	7B	7B	7B	7B	14	14	14	14	14	14
JAPAN	14A	14	7B	7B	7B	7B	7B	7	7B	7B	14	14
MEXICO	14A	14	14	7	7	7	7A	14	14A	21	21	21
PHILIPPINES	14	14	7B	7B	7B	7B	7B	14B	14	14	14	14A
PUERTO RICO	14A	14	14	7	7	7	14	14A	21	21A	21A	21
SOUTH AFRICA	14	7A	7B	7B	14B	14	21A	21A	21A	21A	21	21
U.S.S.R.	7	7	7	7	7B	7B	14	14	14A	14A	14	7B
WEST COAST	21	14	7A	7	7	7	7	14	21	21	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7	7	14	21	21A	21A	21A	21
AUSTRALIA	21A	21	14	7B	7B	7B	7B	14B	14B	14	21	21A
CANAL ZONE	21	14	14	14	7	7	14	21	21	21A	21A	21A
ENGLAND	7	7	7	7	7	7	14	14	21	21	14	14
HAWAII	21	14A	14	7	7	7	7	7	14	21	21	21
INDIA	14	14	7B	7B	7B	7B	7B	14B	14	14	14	14
JAPAN	14A	14	14B	7B	7B	7B	7	7	7	7A	14	14
MEXICO	14	14	14	7	7	7	7	14	14A	21	21	21
PHILIPPINES	14A	14	14B	7B	7B	7B	7B	14B	14	14	14	14A
PUERTO RICO	14A	14	14	7	7	7	14	14A	21	21A	21A	21
SOUTH AFRICA	14	7A	7B	7B	7B	7B	14A	21	21A	21A	21	21
U.S.S.R.	7	7	7	7	7B	7B	14B	14	14A	14A	14	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	14A	14	14	7A	7	7	14A	21A	21A	21A	21
AUSTRALIA	21A	21A	21	14	14	14	14B	14B	14B	14	21	21A
CANAL ZONE	21	14	14	14	7	7	14	21	21	21A	21A	21A
ENGLAND	7	7	7	7	7	7	7B	14B	14	14A	14	14
HAWAII	21A	21	14A	14	14	7A	7	7	14	21	21A	21A
INDIA	14	14A	14	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	21	14A	14	14B	7B	7	7	7	7	14	14	14
MEXICO	21	14	14	7	7	7	7	14	14A	21	21	21
PHILIPPINES	21	14	14	14B	7	7	7	7	14	14	14	14A
PUERTO RICO	21	14	14	7A	7	7	14	14A	21	21A	21A	21
SOUTH AFRICA	14	7A	7B	7B	7B	7B	7B	14	21	21A	21A	21
U.S.S.R.	7B	7B	7	7	7B	7B	7B	14B	14	14A	14	7B
EAST COAST	21	14	7A	7	7	7	7	14	21	21	21A	21A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.
NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

SEPTEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F/G	2 F/G	3 F/F	4 P/F
5 F/G	6 G/G	7 G/G	8 G/G	9 G/G	10 G/G	11 G/G
12 F/F*	13 P/F*	14 F/G	15 G/G	16 G/G	17 F/F*	18 F/F*
19 F/F	20 F/F	21 G/G	22 G/G	23 F/G	24 F/F	25 F/F
26 F/G	27 F/G	28 F/G	29 F/G	30 G/G		

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October 1982 $2.49½
Issue #265

73

Amateur Radio's Technical Journal

A Wayne Green Publication

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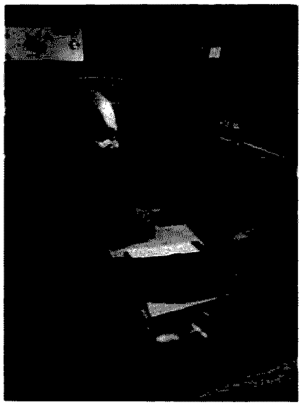
Navassa—134

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



THE OLD MAN

With my 60th birthday coming up September 3rd, I find myself retrospecting . . . and wondering how much time is left. I can't complain, for I've enjoyed putting out *73 Magazine* for the last 22 years and I've had the excitement of being there when many of the interesting things happened.

Back when I first got into amateur radio, I used to go to the hamfests and be amazed at Ted McElroy and his ability to copy high-speed code. What a show he put on! He'd tune in some code at around 50 wpm and talk with the people around him for awhile, then turn to his typewriter and make it sound like a 100-word-per-minute Teletype™ machine. As I recall, Ted not only was the fastest man in the world in copying code, but I think he had some speed records in typing, too. Heady stuff for a kid.

Then, soon after the war, I happened to be in the right place at the right time to participate in some of the early narrowband FM experiments. I modified an old SCR-274 transmitter and a Meisner Signal Shifter with reactance modulators and had a ball. Of course, I'd been building ham gear since 1937 (golly, that's 45 years ago!), so my ham shack was piled high with equipment by 1946. I still have hams say hello at hamfests who visited my shack in those days and marveled at the collection of things I'd bought (surplus) and built. I loved to build.

The true old-timer is the chap who made tube socket holes in steel chassis by first drilling a small hole and then enlarging it with a rat-tail file for the socket. Oh, there were socket punches, but they were darned expensive. It was a long time before I managed to buy a set of those elite tools.

Then there was John Williams W2BFD, the grandpappy of ham RTTY. Oh, others helped, but it was John that really got it all started. He did most of the early experimenting, arranged to get the equipment, distributed it, and wrote articles about it. It was his work that got me going on RTTY in 1948, which in turn got me to start a RTTY magazine back in 1951. I've been editing and publishing ever since. John was a cranky, sneaky old man, and he was a good friend. It's a shame he died in 1961, for he would have loved solid state and ICs. But he didn't take care of himself (smoked), so one day he keeled over. He lived and died for amateur radio.

Then there was Sam Harris W1FZJ, another irascible genius and a good friend. Sam made the first practical parametric amplifier. He also did a lot of the early moonbounce hamming, culminating in his working for the big dish folk at Arecibo.

On the other side of the coin, I had the fun of knowing Don Miller rather well . . . and getting sued by him when I blew the whistle on his false DXpeditions. I've never written the entire story of *that* one, but I should. No, that's not the same Don Miller that got shafted by the League a couple years ago . . . different chap. The older Miller is, I believe, in prison in California for trying to get some chap to kill his wife. The League Miller is, I understand, about to run for director again. That should be an interesting election. Since, as far as I could discover, he was kicked out of the job on a trumped-up charge, I'd like to see him win this one. And I say that despite some of the unkind things Don has said about me at ham clubs.

Even after 45 years of ham radio, I still get a kick out of getting on 20m and making contacts . . . either around the US or with some good DX. A couple years ago I was out there climbing our mighty Mount Monadnock to get at the head of the line for 10-GHz DXing, with seven states contacted. No one has come close to equalling the record yet. That was hard work . . . and fun. I think the mountain climbing may have taken a year off my life . . . but that is nothing compared to the dent my first wife made in it.

Just managing to survive with *73* for all these years has been a miracle. Remember that I'd just really gotten started with it when the "incentive licensing" debacle hit in 1963 and stopped the growth of amateur radio for 10 years. That's when three-quarters of the ham dealers and 95% of the manufacturers went out of business. At one time the magazine staff was down to five people, working day and night to try to keep things going.

With the ham industry picking up a bit due first to FM and repeaters and then from an influx of CBers, I kept things going. The invention of the microcomputer sparked me to start *Byte* magazine . . . and then *Kilobaud*, Instant Software, *Selling Micros*, *80 Micro*, Load 80, and *Desktop Computing*. We went from a few people to a staff on the order of 250, with buildings all around town. We still have more magazines in the works with no end in sight.

One of the benefits of getting the business to this size is that my ideas have a better chance of getting attention. I suppose that at 60 I should start to slack off and not work so hard. I still put in a hundred-hour work week and keep up with reading some 200 or so magazines a month . . . plus a few books. Add that to my travel schedule to hamfests, computer shows, and to give talks. I count 18 shows so far just this year, nine talks, several Washington trips for NIAC, a couple of consulting trips, and a short visit to Colombia. Not bad when you consider we're only into July at this writing.

Yes, partly I'm bragging. But that isn't all of it. I do want you to know that I'm doing all this with a goal in mind of providing you with a magazine which is interesting, which will, I hope, inspire you to enjoy amateur radio more, and which may bring education to more of the world. I feel that I'm doing the best I can and I hope that you'll help me towards my goals with subscriptions, with articles, and by getting youngsters into amateur radio.

Though I've got a wonderfully supporting bunch of people working with me, we need more help. We're getting a big new magazine started this fall and would like to start some more next year, if we can get the people to help with the work. We have a wondeful bunch of people who are enjoying what they

ATTENTION, AUTHORS!

73 Magazine is always searching for good articles, and now may be your chance to share the fame and fortune enjoyed by hundreds of other readers-turned-authors. We are looking for construction articles, antenna articles, club project articles, and so forth. Articles on any subject dealing with amateur radio are considered, but our primary emphasis is on construction. If you need help in getting your manuscript up to snuff, we will send you a copy of "How to Write for *73*" (free for an SASE). Please send your request or manuscript to: Editorial Offices, *73 Magazine*, Peterborough NH 03458.

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do...and are learning. There isn't a better part of the whole world in which to live than New Hampshire.

While I enjoy publishing the magazines, my main goal is to try to get American technology so we can catch up with Japan. To this end I believe we need a monumental growth of amateur radio, attracting the teenagers to the hobby. Then we need better colleges to teach them and turn them loose to build new businesses and provide us with the telecommunications and computers we are going to need in the next ten and twenty years.

With your help, I think we can get the amateur rules so they are better in tune with the type of technical enthusiast we need. With your help, we can get ham clubs going in every high school in the country. With your help, we can set up a pilot model of the college that is needed... and then help it proliferate. Has anyone franchised colleges yet?

At Comdex, the computer show in Atlantic City a couple of weeks ago, I was most pleased to meet so many computer company presidents who walked up to me and gave me their call letters. I wasn't surprised, for amateur radio gives a youngster a tremendous head start over everyone else when it comes to a technical career.

I've got to lose about ten pounds I put on eating at the shows and I've got to spend some time getting in shape for skiing this winter. That, plus getting a new magazine going and hitting the show circuit again this fall, should keep me busy. Do I hear any interest from readers in joining me on the show trip to Tokyo, Seoul, Taipei, Hong Kong...and on to 9V1, 9M6, VS5, 9M8, DU?

THE NON-DXPEDITION

Some 700 DXers who worked KF1O portable on CE0X on San Felix Island (off Chile) were somewhat upset recently when the League discredited the operation. One of the DX bulletins had further details. It was reported that the Chilean government had claimed the documents as forgeries. The Chilean club was up in arms about the whole situation.

A day or so later I received a letter mailed from Greece from Bob Read KF1O with copies of some CE0X documents but no explanation. These papers were copies of copies, so there

Continued on page 100

Well...I Can Dream, Can't I? by Bandel Linn K4PP

"Sony to hear about your line noise! We're rerouting our power lines seven miles to the west!"

The Splattometer

—visual overmod warning

Ed. Note: "The Splattometer" was one of the honorable mention winners in our Home-Brew Contest. W1BG will be receiving a $50 bonus in addition to his normal article payment.

Penn Clower W1BG
459 Lowell Street
Andover MA 01810

The most common way to abuse a sideband signal at the transmitter is by overdriving the output amplifier. That generates splatter, spurious signals which can cause interference up to 50 kHz or more from the normal transmission frequencies.

The "Splattometer" connects easily into the transmission line, monitors the output signal, and flashes a warning lamp whenever it detects flattopping. An entirely new type of signal analyzer, it is a real help in getting the most power from a transmitter while minimizing splatter. The entire instrument, including the built-in ac power supply, can be built for $65 using all new Radio Shack components, or for much less if your junk box isn't completely empty.

Amplifiers used in sideband transmitters are linear amplifiers. That means the output signal, aside from being more powerful, should be an exact replica of the input signal. Amplifiers have limits, however, and overdriving one can cause it to exceed its linear range so that the peaks of the output waveform get clipped or flattened. These flattops cause the signal to splatter extra energy onto adjacent frequencies.

Splatter can be hard to control for several reasons. Operators naturally want to run their transmitters at full power, and that often leads to running the microphone gain too high. An swr-type power-output monitor will show more output power, but unfortunately much of that extra power is spread up and down the band.

Monitoring a transmitter for splatter until now also has posed a problem since it required the use of an oscilloscope. That solution can be complex and expensive. As a compromise, most hams leave the microphone gain control set at some customary point and hope the ALC is working well enough to avoid splatter. For some people that works and for some it doesn't. It usually doesn't work at club stations where operators may not be too familiar with the equipment, and it usually doesn't work during contests when the race is on and every Watt counts.

Photos by W1GSL

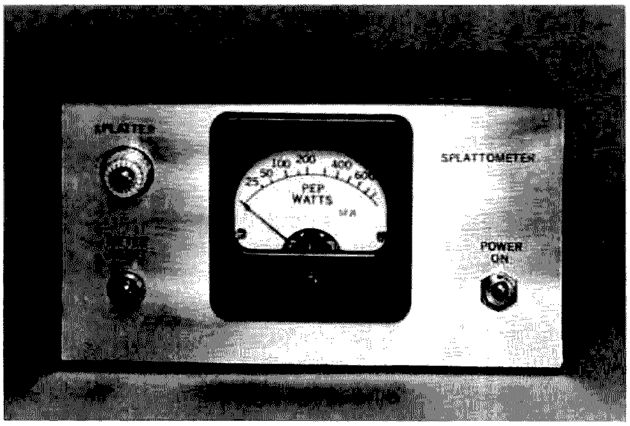

Photo A. The uncluttered 4" by 7½" front panel is dominated by the PEP wattmeter and splatter-alarm lamp. Only two operating controls are required, a power switch and reset push-button.

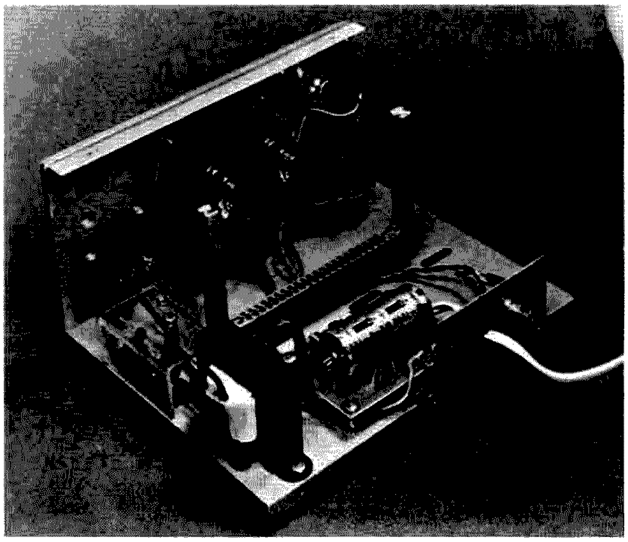

Photo B. Interior view of the recycled cabinet. The main circuit card plugs into the empty card socket while the power supply is mounted separately. Note that the rf voltage divider resistors are mounted directly on the input connector. A plastic shield keeps stray fingers off the ac line fuse.

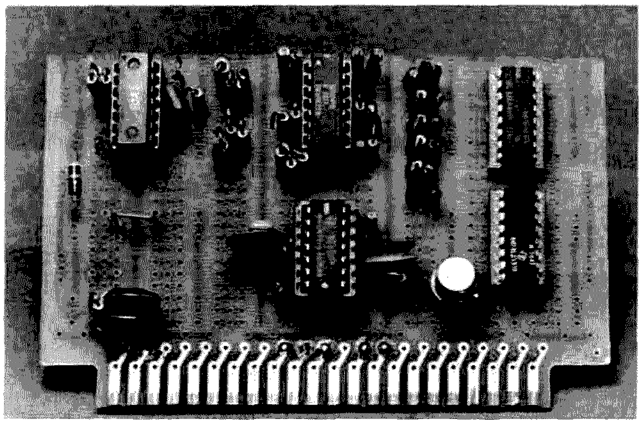

Photo C. *Five ICs and the lamp driver transistor pack a lot of functions into a small space. The rf detector/filter components are grouped by themselves in the lower left-hand corner of the board. From left to right across the board are the quad op amp, quad comparator and dual timer, and finally the two up/down counters. One-quarter Watt resistors and miniature capacitors are mounted on end to save space.*

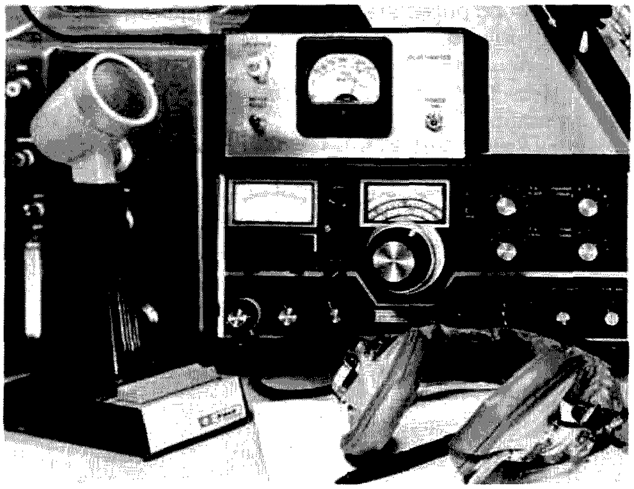

Photo D. Although it fits nicely on top of the transceiver, the Splattometer can be placed anywhere within the operator's field of view. It doesn't need constant attention; when you splatter, it lets you know with a bright flash.

The "Splattometer" is a much better alternative. This simple flattop-monitor and -alarm circuit is usable over a wide range of transmitter power levels. The circuit basically consists of two sections. The first measures the peak voltage present in the transmitter signal. The second section measures how long the transmitter output has been at that maximum level. A clean SSB signal will just peak briefly to the transmitter's maximum output, but a splattering signal will be clipped and so stay at that level for a longer time. That time at maximum power is detected by the circuit and triggers the splatter indicator.

How It Works

A block diagram of the circuit is shown in Fig. 1. The antenna cable is looped through the unit and a small portion of the rf voltage is sampled with a restive divider. This signal is rectified and lightly filtered to create an accurate audio frequency reproduction of the rf envelope.

The peak-voltage measuring portion of the instrument is built around an up/down counter and simple six-bit digital-to-analog (D/A) converter. The converter output is a dc voltage nominally equal to the peak level of the detected rf waveform. If the detected level peaks higher than the existing D/A output, the counter gets clocked a step higher, thus raising the D/A output voltage. This feedback-controlled up-counting by itself would eventually set the converter output just above the rf peak voltage.

The counter, however, is also being clocked downward about two steps every second; as a result, the D/A converter output tracks within one or two steps (about .2 volts) of the detected peak envelope level. A threshold circuit freezes the counter state when the rf signal disappears between words, sentences, or transmissions. The dc measurement of the peak signal level also drives a simple voltmeter whose scale is calibrated to show the PEP Watts the transmitter is delivering to a 52-Ohm load. Notice that the relatively crude 6-bit D/A converter is perfectly acceptable since the feedback around the counter automatically adjusts the dc output to match the peak input. The actual counter state and converter linearity simply don't matter.

The flattop-detection portion of the Splattometer starts by low-pass-filtering the detected rf envelope with a one-millisecond time constant. This means that if the rf envelope suddenly jumps from zero to maximum, the filter outputs will take about three milliseconds to follow it. The splatter indicator is triggered whenever the output of this filter is greater than 80% of the measured peak signal level. The 80% and 1-ms time constant were chosen so that the instrument will detect any flattop lasting longer than 2 ms.

The output indicator is a panel lamp driven by an IC timer which generates a .1-second-long pulse whenever a flattop is detected.

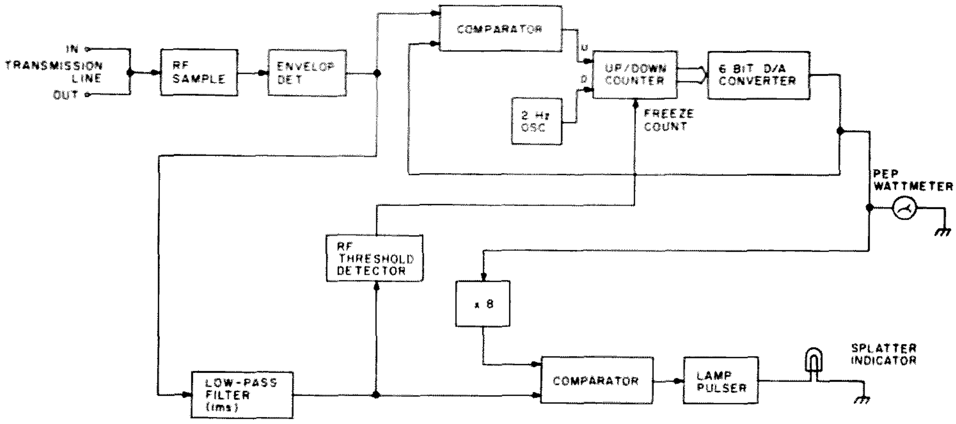

Fig. 1. Splattometer block diagram.

The .1-second pulses are just long enough to produce a bright eye-catching flash on each detection. This visual alarm works well.

One of the nicest features of the Splattometer is that you don't have to concentrate on watching it the way you would an oscilloscope. It just sits quietly off to the side until you start talking too loudly and then *Flash!*, it grabs your attention. A useful modification of the output indicator, particularly for sightless hams, would be to replace the lamp with a 4.8-kHz piezoelectric buzzer. The operator would certainly hear the buzzer, but its frequency would be too high to get past the transmitter's SSB generator.

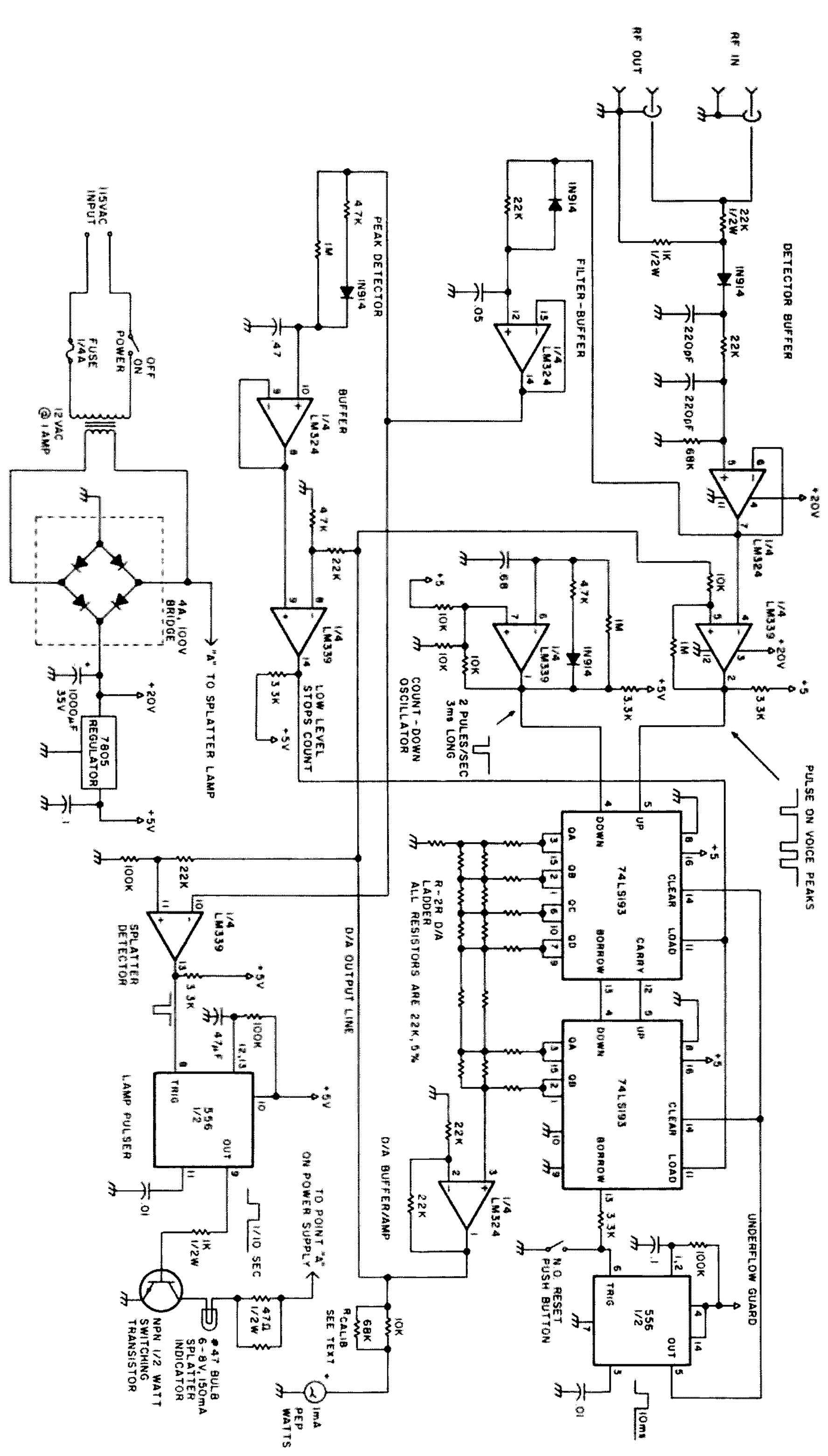

Fig. 2. Schematic diagram.

The complete circuit diagram is shown in Fig. 2. The circuit proper uses just five ICs, and the power supply contains a sixth for 5-volt regulation. An LM324 quad op amp is used to buffer the several RC filtered signals and acts as the D/A output amplifier. A quad LM339 comparator gates the counter-up, counter-hold, and splatter-detection signals. The last comparator section is used in the 2-Hz countdown oscillator. One section of a 556 dual timer generates the output indicator pulses while the other prevents the counter state from underflowing from zero to all ones. That second timer section can also be triggered by the front panel push-button to reset the counter to zero. The reset button isn't used much except at power turn-on when the counter is likely to come up in an unrealistically high state.

The counter uses two 74LS193s. The standard 74193 chips will work just as well, but the extra 10¢ cost per chip seemed like a worthwhile expense in terms of reduced power consumption. The D/A converter is an R-2R ladder made entirely with 22k resistors. Five-percent resistors were used without problem, although the conversion linearity is poor. That doesn't matter, as mentioned earlier, and the 64 output levels are adequate for proper circuit operation.

The simple power supply has one unusual feature. The main circuit board requires 12 to 20 volts at 10 mA or so and 5 volts at 45 mA. Those needs are easily met with the 1000-uF filter capacitor and the 5-volt regulator. The indicator bulb draws about 150 mA, though, and if taken from

the 20-volt supply, this is enough to drop the filtered dc level several volts and significantly increase the ripple. As an alternative, the bulb is powered from the half-wave rectified voltage present between ground and either input side of the bridge. The rms level there is a better match for the bulb's design voltage, and the bulb current has little impact on the 20-volt supply since it is isolated from the filter circuit. The two 47-Ohm resistors in series with the bulb limit the current so that the lamp brightness is about the same as when powered from a true 6-volt source.

Construction

As can be seen in the photographs, my unit makes liberal use of flea-market components. The parts list specifies equivalent Radio Shack parts which can be used to build a similar-looking unit. Total cost using all Radio Shack parts is around $65, but there are many corners which can be cut to reduce that price.

My flea-market cabinet is a real deluxe job, so the parts list specifies a correspondingly nice $9 unit. A similar-size Bud Minibox or other enclosure would work as well and cost much less.

The Radio Shack meter also costs $9, but many surplus outlets having advertisements in *73* regularly offer similar meters at less than half that price.

My junk box contained a salvaged plug-in-type circuit board and socket; those two items purchased new total almost $7. Obviously the plug-in feature is nice, but it is also completely unrelated to the electrical operation of the circuit.

Radio Shack components are of reasonable quality and readily available, so they are a good yardstick to use in measuring the maximum cost of this project. Remember, however, that with a little resourcefulness, the cash outlay can be substantially reduced.

Using Radio Shack component values is also sometimes difficult. The R-2R ladder in my unit is actually constructed with 10k and 20k resistors. The schematic and parts list specify 22k resistors because they were in the Radio Shack catalog, but using only that size requires paralleling 5 extra resistors to create the 11k values. Electrically that's perfectly acceptable, but physically it's somewhat bulky. If you do buy the 22k resistors, the entire project uses 23 of them. Since only 17 go in the ladder network, be sure to use the opportunity to select out the closest matched group of 17 with an ohmmeter.

You'll see in Photo B that I used a single rf connector while the schematic shows a two-connector loop-through. I run the transmission line right by the back of the instrument and use a tee connector to connect to the input of the Splattometer. The two-connector loop-through is preferable as it avoids completely the temptation to connect the instrument to the line with a single length of cable, cable which would look like a reactive stub on the higher bands and so interfere with transmitter tuning.

Note also that the resistive divider is mounted directly on the back of the input connector. That minimizes stray coupling problems by keeping the large rf voltage away from the main circuit board.

For the same reason, the rf detector and filter components are grouped by themselves in one corner of the main board. I mounted the ac fuse inside the box since the back panel opening on my cabinet wasn't large enough for the ac line, rf input connector, and fuse, too. The parts list specifies a panel-mounted fuseholder since most people won't have my space problem.

The simple power supply is built as a separate unit. Certainly that handful of parts could be placed on the main board with the rest of the circuit. The advantage of the separate approach is that is is easier to disconnect and test the power supply by itself. It's also convenient to be able to insert current meters between the supply and main circuit during checkout.

The front panel can be laid out in any desired manner. Try to choose a lamp holder which will easily be visible over a wide angle. One advantage of the flashing indicator is that it can attract attention without being constantly watched. Don't ruin that feature by using a lamp assembly which has a narrow viewing angle. I didn't include a power-on indicator lamp on the assumption that it might lessen the visual impact of the splatter indicator.

The PEP wattmeter is actually a dc voltmeter reading 0 to 8.5 volts, so any dc current instrument with a full-scale range of 5 mA or less will work with a suitable selection of series resistor. The rf sampler and filter circuits of the Splattometer are designed so that a 3-volt dc output at the D/A converter corresponds to 100 Watts PEP delivered to a 52-Ohm load. Power is proportional to voltage squared and the D/A output can range from almost zero to 7.5 volts, so the meter will read from near zero to about 700 Watts PEP. Meter calibration is quick and easy using the calibration chart shown in Fig. 3.

I made a whole new face for my junk-box meter using India ink, press-on transfers, and a piece of good writing paper pasted to the *back* of the old metal meter face. The back of the metal plate

A SPLATTER DETECTOR FOR PROCESSED AUDIO?

Several people have independently suggested how to build a splatter detector which might work with both processed and natural audio. The suggested technique is certainly worth passing along as a guide to further experimentation. The idea is to identify the sharp clipped corners which cause splatter by doing some frequency analysis on the AM-detected SSB envelope. In this approach, the output of a lightly filtered AM detector would be separated into two channels—one each for frequencies above and below 3 kHz. Ideally, the signal filtered into the low-pass channel would be all "good" energy while the high-pass channel would contain only splatter signal. These two audio channels could then themselves be rectified, filtered, and compared in magnitude to provide some measure of the amount of splatter at any given time.

I see two main problems with this approach, one practical and one theoretical. First, the low-pass and high-pass filters may be difficult to design in an easily reproduced form. There will be a lot of signal in the low-pass channel, but not much in the high-pass section: perhaps 30 to 50 dB of rejection will be required over a small (less than an octave) frequency range. Each channel will probably need three or more cascaded active filters with closely matched cut-off frequencies, Q, and passband ripple. Second, the high-pass channel will also contain signals not caused by splatter—the 3rd and 5th order distortion products—and these signals may confuse the splatter-detection process. Their presence certainly adds an interesting element to the trade-off between time and frequency domain analysis. The detection approach outlined in Fig. 1 has a lot of positive features: it works fine with unprocessed audio, is auto-adaptive over a wide range of input levels, is easily reproduced, and is low in cost. The processed audio problem is ripe for experimentation and perhaps some readers would like to give it a try.

Rf Input Power Level (Watts)	D/A Output Voltage	Meter Reading (If full scale is 1.0)
25	1.5	.177
50	2.12	.25
100	3.00	.353
150	3.67	.432
200	4.24	.50
300	5.20	.612
400	6.00	.707
500	6.71	.79
600	7.35	.866
700	7.94	.935
800	8.49	1.00

Fig. 3. Meter calibration points.

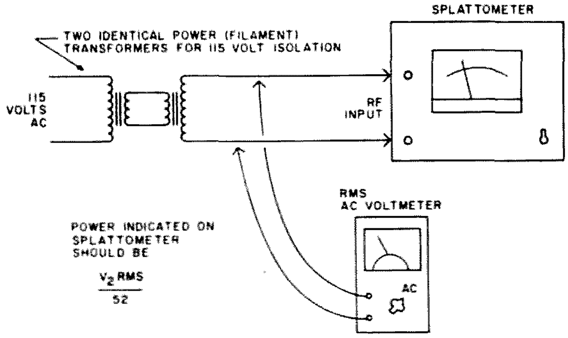

Fig. 4. Calibration using the 115-V, 60-Hz line.

is blank, of course; the original scale would show through paper glued to the front of the faceplate. To make the scale, draw an arc on the new meter face, replace the faceplate and connect the meter to a variable power supply through a resistor sized to make 8.5 volts read full scale. With a 1-mA meter, that resistor should be just under 8.5k. The schematic shows a 10k resistor in parallel with a higher value; 56k will do the job almost exactly. If you purchased the Radio Shack resistors, there will be a spare 68k, ¼-Watt resistor which will work fine.

With the chosen resistors in place, set the supply to 8.5 volts and mark that pointer position as 800 Watts. Now go down through the middle column of Fig. 3 marking the wattage levels at the corresponding voltage points. Finish up by removing the faceplate and adding the dry transfer numbers at the appropriate spots. If you don't want to go through the trouble of making a new meter face, the third column of Fig. 3 can be used to make a conversion chart for the existing scale on a 1-mA instrument.

For convenience, I built the main circuit on a plug-in prototype card. This board comes drilled with .1-inch spaced holes and has an array of printed circuit pads etched on one side. The IC sockets and passive components are mounted on the front of the board and the interconnections are made from the rear with short lengths of wire. Wire-wrap wire is nice to use for the wiring because of its small size. The finished board doesn't look as nice as a real printed circuit card, but it is quicker to make, works as well, and is easier to modify should a reason arise. If you wish, you can save some money by skipping the plug-in feature and hard-wiring the necessary external connections to a standard prototype board.

Checkout and Operation

There is nothing critical about this circuit that has to be "tweaked" in to allow proper operation. If the project doesn't work when first turned on, the reason is most likely a wiring error or sloppy soldering, so check your work carefully. It is always prudent to try the power supply first, making sure the proper operating voltages are there. With everything connected, the meter will probably read upscale when the power is switched on. This is because the counter stages turn on in some random condition. Pushing the reset button should drop the meter pointer almost to zero.

Connect a transmitter through the unit to a dummy load and tune up for normal SSB operation. To maintain calibration accuracy, the Splattometer should always be inserted in the line at a low swr position, that is, between the transmitter and antenna coupler if one is used. Push the reset button after tuning up, key the transmitter, and say a few words into the microphone. The splatter lamp will flash on the first few syllables and the meter will move rapidly upscale. The Splattometer has now calibrated itself to your transmitter's PEP output and is watching for flattopping. The meter will flicker only slightly as you continue to talk; between words and transmissions it will hold dead still. The typical efficiency of a linear amplifier is around 60%, so if the transmitter is rated at 200 Watts PEP input, the meter should indicate about 120 PEP Watts output.

Now turn up the microphone gain, talk more loudly, or cluck into the microphone. The splatter lamp will flash but the PEP output meter won't move upward any more than when you were talking normally. If you have an swr bridge or averaging power meter in the line, you'll notice that it *does* indicate more power when you flattop. A lot of amateurs make themselves unpopular because they don't realize some of that "extra" power is just splatter.

Incidentally, during CW operation the splatter lamp will flash on every key closure since the CW signal is detected as a severely distorted SSB signal!

One limitation of the Splattometer circuit is that it may not respond properly when speech processing is used. This failure results from assuming that splatter is always associated with an extended period of maximum transmitter output. The splatter isn't *generated* during the clipped interval, however; it's really a result of the sharp transition between the flattop level and the rising (or falling) envelope power at the beginning (or end) of the clipped peak. Key clicks on a poorly-shaped CW signal are caused in exactly the same manner. When normal unprocessed audio is used to generate the SSB signal, any peak clipping would be expected only in the output amplifier, so in that case splatter and limiting go together and the Splattometer will work beautifully.

With processed audio, the situation is different. Speech processors, whether designed to work at audio or rf, generally contain somewhere in their makeup a compression amplifier, clipper, and filter. The amplifier brings up the relative amplitude of the weaker voice sounds, the clipper limits the peak output level, and the filter removes the high-frequency distortion products caused by the clipping action. The SSB envelope produced with processed audio can have flattened peaks holding at the maximum output level for relatively long periods of time. Such peaks do not in this case indicate the existence of splatter because the clip-

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ping occurs in the speech processor (where it is also "cleaned up" with a filter) and not the transmitter's final amplifier. The Splattometer will detect these peaks and incorrectly indicate the signal is splattering.

This shortcoming is really not the handicap it first appears to be. Once the clipping level in the processor is correctly set, that circuit will prevent the transmitter output stage from being overdriven into saturation—no matter what happens at the microphone. Increased audio input to the processor or increased amounts of compression will raise the average output power (and the amount of distortion in the audio recovered at the distant receiver), but the *peak* input to the final amplifier will be safely limited by the processor's clipper and splatter will not occur. The Splattometer is needed most in the situation where it works best: an SSB transmitter running with unprocessed audio. In that case, clipping is most likely to occur in the transmitter's output stage. Such clipping will cause splatter and the Splattometer will correctly identify the condition.

PARTS LIST

Item		Number Needed	Radio Shack Part Number	Quantity per pack
Resistors				
47 Ohms,	½ W	2	271-009	2
1k	½ W	2	271-023	2
22k	½ W	1	271-038	2
3.3k	¼ W	5	271-1341	5
4.7k	¼ W	3	271-1330	5
22k	¼ W	23	271-1339	5
10k	¼ W	5	271-1335	5
100k	¼ W	3	271-1347	5
1 Meg	¼ W	3	271-1356	5
68k	¼ W	1	271-1345	5
Capacitors				
1000 uF,	35 V	1	272-1019	1
220 pF		2	272-124	2
.01 uF		2	272-131	2
.1 uF		2	272-135	2
.47 uF		2	272-1417	1
.68 uF		1	272-1418	1
.05 uF		1	272-134	2
Semiconductors				
1N914		4	276-1122	10
4 A, 100 V bridge		1	276-1171	1
7805 regulator		1	276-1770	1
NPN transistor		1	276-2030	1
LM324 quad amp		1	276-1711	1
LM339 comparator		1	276-1712	1
74LS193 counter		2	276-1936	1
556 dual timer		1	276-1728	1
Miscellaneous Electrical				
1-mA meter		1	270-1752	1
12-V transformer		1	273-1505	1
#47 lamp		1	272-1110	2
¼-Amp fuse		1	270-1270	3
Hardware				
Power switch		1	275-602	1
Reset switch		1	275-609	2
Fuse holder		1	270-364	1
Lamp socket		1	272-325	2
Rf connector		2	278-201	1
Cabinet		1	270-269	1
Plug-in board		1	276-153	1
Board socket		1	276-1551	1
Circuit board (for power supply)		1	276-158	1
16-pin sockets		2	276-1998	2
14-pin sockets		3	276-1999	2

The final wattmeter accuracy is dependent on several things but should be within 10 or 15 percent without further adjustment. If you're really finicky about such things, it can be set on the nose with an isolated 60-Hz source and a good ac voltmeter. Use a 1:1 isolation transformer or two filament transformers back-to-back as shown in Fig. 4 and feed the output into the Splattometer. Measure the equivalent input power as the square of the rms voltage divided by 52. If necessary, the series meter resistor can be adjusted so that the pointer exactly indicates the calculated power.

Wattmeter accuracy is also dependent on swr. Remember that the wattmeter is really a peak-reading rf voltmeter which can be calibrated in Watts only because the load is specified as 52 Ohms and $P = E^2/R$. The wattmeter scale will be inaccurate if another load impedance is used; for example, if the load is doubled to 104 Ohms, the indicated power will be twice the actual power. If the transmission line swr isn't 1:1, the problem is harder to solve since the wattmeter readings will vary with the electrical length of the line. The rf voltage on a line having 2:1 swr will vary over a 2 to 1 range depending on line length. The indicated power, if based only on the voltage measurement, would vary over a 4 to 1 range—from about half to twice the actual power! The Splattometer's PEP wattmeter can be calibrated and used as a worthwhile test instrument, but don't forget to consider errors caused by swr. The splatter-detection portion of the instrument will of course be unaffected by swr as long as the wattmeter reading settles out to something between 25 and 700 Watts.

The resistor values at the input rf voltage sampler can be changed to shift the Splattometer operating range if desired. Reducing the 1k resistor to 510 Ohms almost doubles the input voltage necessary to create a specific meter reading, so the instrument will then read from about 100 to 3000 Watts. For low-power operation, the 22k input resistor can be reduced to 9.1k and the resulting range will be approximately 4 to 120 Watts PEP.

During normal SSB operation, the splatter lamp should flash only occasionally, maybe once or twice per sentence. Any more than that is too much and calls for a reduction in microphone gain.

Nobody wants to overdrive his transmitter and cause splatter, but the desire to get maximum output power is a strong one. Until now, the preferred monitoring technique required an oscilloscope. That solution is bulky, expensive, and requires constant attention in a dim room. The Splattometer is a much better alternative: It's inexpensive, unobtrusive, and, unlike the complex oscilloscope display, tells you only what you want to know exactly when you need to know it. You'll certainly find it a worthwhile addition to your equipment if you operate much SSB. Even if you're primarily a CW operator, it might make an excellent Christmas present for that SSB operator down the block! ■

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Digital Basics

—part II

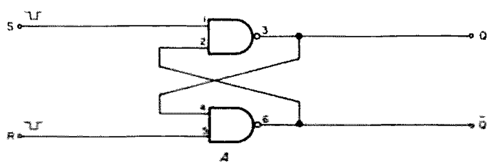
In part I of this series, I introduced you to the principal IC logic families and the various different forms of logic gates. Here in part II, we will continue our study of basic digital electronics by investigating *flip-flops*.

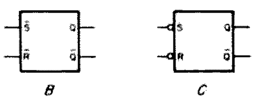
Flip-Flops

All of the digital circuits discussed thus far have operated in a "transient" manner. Gates and inverters do not have any *memory*, so once the input condition changes, then the output state that results from those conditions also is likely to change.

A flip-flop (FF) is a circuit that is capable of *storing a single bit* (i.e., a binary digit, either 1 or 0) of digital data; it will remember an input condition and hold the same output after the data has passed. There are various different types of flip-flop circuits, and they all operate on slightly different (even though similar) sets of rules. But one thing that they all have in common is the ability to store a single data bit.

All common forms of flip-flops can be made from various combinations of the basic AND, OR, NAND, NOT, NOR, and XOR gates. The NAND, NOR, and NOT gates are particularly often used to make flip-flops. Except for the two simplest flip-flops presented here in part II, most electronic circuits use IC flip-flops instead of actual IC gates. It is simply too costly to *make* flip-flops from IC gates when the same manufacturers do all of the interconnections for you by offering the various flip-flops pre-made in IC form.





S	R	Q	Q̄
0	0	DISALLOWED	
0	1	1	0
1	0	0	1
1	1	NO CHANGE	

D

Fig. 1. (a) A reset-set flip-flop (RS FF) can be made from two NAND gates. (b) Symbol for RS flip-flop. (c) The circled inputs for R and S indicate that these inputs are active-LOW. (d) The operation of an RS flip-flop is summarized in this truth table.

Reset-Set (RS) Flip-Flops

One of the simplest forms of flip-flop circuit is the *reset-set*, or *RS*, flip-flop. (Some textbooks, especially those over ten years old, call it a set-reset, or SR, flip-flop.) The RS flip-flop can be made from either two NAND gates or two NOR gates, although note that operation of the two versions is slightly different.

Fig. 1(a) shows the circuit for an RS flip-flop made from a pair of NAND gates, such as the TTL 7400 device (which contains four two-input NAND gate sections).

There are two inputs required on the RS flip-flop, *set* and *reset*. Usually there are also two output terminals, and these are complementary: Q and NOT-Q ($\overline{Q}$). *Complementary* means that one will be LOW if the other is HIGH. For example, when the Q output is HIGH, then the NOT-Q will be LOW. When the Q output is LOW, then the NOT-Q will be HIGH.

The inputs of the NAND version of the RS flip-flop are active-LOW so are sometimes designated $\overline{S}$ (NOT-S) and $\overline{R}$ (NOT-R). Whenever you see an *input* that is designated as a NOT-input, has a bar over its symbol, or that has a circle in the schematic diagram, then we know that it is an active-LOW input terminal. The circuit action of an active-LOW input occurs when the terminal is brought LOW. An example of a schematic that uses the circled inputs is shown in Fig. 1(c), while the normal symbol for the RS flip-flop is shown in Fig. 1(b).

A momentary LOW on the *set* input of the NAND gate RS flip-flop causes the outputs to go to the state where the Q is HIGH and the NOT-Q is LOW. Note that the term *set* usually means Q = HIGH and NOT-Q = LOW, while *reset* indicates just the opposite: Q = LOW and NOT-Q = HIGH. The flip-flop is said to possess *memory* (and, indeed, solid-state computer memory uses arrays of FFs), so the outputs will stay in the set condition unless a *reset* pulse is applied to the *R* input.

The reset function is obtained by momentarily bringing the reset input LOW. This forces the outputs to go to a state in which the Q is LOW and the NOT-Q is HIGH.

The rules for the operation of the NAND-logic RS flip-flop are summarized in the truth table shown in Fig. 1(d). This truth table also lists two additional conditions besides those discussed above. One of these is the condition in which both set and reset inputs are brought LOW simultaneously. This is a *disallowed* state, and the circuit will not know what to do; the output state will be unpredictable.

The other condition is the case where both inputs are simultaneously HIGH. In this condition we find that there is no change in the output state. The RS flip-flop simply remains in the condition present when the inputs were made HIGH.

A NOR-logic version of the RS flip-flop is shown in Fig. 2. This circuit may be constructed from TTL/7402 NOR gates. Like the 7400 device, the 7402 contains four independent two-input gates (in this case, the NOR variety). The circuit in Fig. 2 performs differently from the NAND-logic version of Fig. 1, but there are similarities even though a slightly different set of operating rules prevails.

The rules governing the NOR-logic RS flip-flop are summarized in the truth table of Fig. 2(c), but let's go over them briefly:

1) If *both* inputs are LOW, then there is no change in the output state.

2) If *both* inputs are simultaneously HIGH, then we have a disallowed state and the output condition is unpredictable.

3) If the *set* input is made HIGH momentarily, then the output condition is Q = HIGH and NOT-Q = LOW.

4) If the *reset* input is made HIGH momentarily, then the output condition is Q = LOW and NOT-Q = HIGH.

Note again the principal difference between the two forms of RS flip-flop (examine the truth tables in Figs. 1 and 2 again). The NAND-logic RS flip-flop has *active-LOW* inputs, while the NOR-logic RS flip-flop has *active-HIGH* inputs.

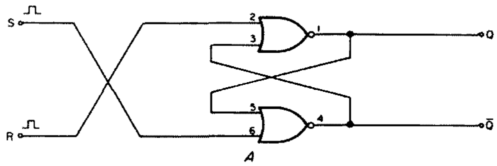
Clocked RS Flip-Flops

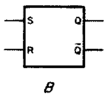
We sometimes get into trouble with flip-flops that are too simple. We see, for example, electronic versions of the old *relay-race* problem. In that problem and its modern electronic version with digital circuits, two relays may have slightly different actuation times. If the time difference is such that they operate out of the intended order, then catastrophic results sometimes occur. Many of these problems are solved in the digital electronics world by using *clocked*, or *synchronous*, operation. In the case of the RS flip-flop, we obtain clocked operation by using the *master-slave flip-flop*, also called the *clocked RS flip-flop*.

The purpose of the *clock* (a train of pulses) is to synchronize the changes in the output condition by allowing them to occur only at certain times during, or immediately following, a clock pulse. Most large-scale digital circuits will use synchronous operation in order to keep things straight.

There are two basic forms of clocking used in RS flip-flops: *level-triggered* and *edge-triggered*.

A level-triggered flip-flop is one in which the output state changes in response to conditions on the inputs only when the clock input is either HIGH or LOW (depending upon the type). Some level-triggered circuits require the clock pulse to be LOW for it to be active, while others (the more usual case) require the clock pulse to be HIGH.

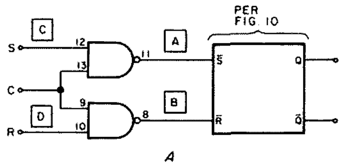




S	R	Q	Q̄
0	0	NO CHANGE	
0	1	0	1
1	0	1	0
1	1	DISALLOWED	

C

Fig. 2. (a) An RS flip-flop can be made from NOR gates as well as NAND gates. (b) The RS flip-flop built from NOR gates has active-HIGH S and R inputs. (c) A NOR-logic RS flip-flop follows this truth table.



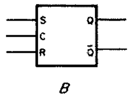


Fig. 3. (a) By adding two NAND gates to a NAND-logic RS flip-flop, a level-triggered clocked RS flip-flop is obtained. (b) Schematic symbol for a level-triggered clocked RS flip-flop.

An edge-triggered flip-flop will allow state changes only during one of the two transitions of the clock pulse. The pulse must be in the process of going from LOW to HIGH, or from HIGH to LOW (again, depending upon type). A positive edge-triggered flip-flop, therefore, will allow output changes to occur only on the positive-going transition (LOW to HIGH) of the clock pulse. A negative edge-triggered flip-flop allows output transitions only on the negative-going (HIGH to LOW) transition of the clock pulse.

It is important to remember the difference between these two types of triggering, so let's reiterate: *Level triggering* means that changes can take place only during the time when the clock pulse is active, i.e., either HIGH (positive level-triggered) or LOW (negative level-triggered); *edge triggering* means that output changes can take place only during the transition period of the clock pulse. A positive edge-triggered FF changes only on the LOW to HIGH transition, while a negative edge-triggered FF wants to see the negative-going, or HIGH to LOW, transition.

An example of a simple level-triggered clocked RS flip-flop is shown in Fig. 3. The main flip-flop is the same as the circuit in Fig. 1, so it is shown here in block form for the sake of simplicity. The *S* and *R* inputs are controlled by a pair of NAND gates. When the clock pulse is LOW, then both inputs of the RS flip-flop section (i.e., points A and B) see a HIGH, so no change can take place.

But, when the clock input goes HIGH, the levels at points A and B (i.e., the *S* and *R* inputs of the FF section) are then controlled by the other inputs of the NAND gates. These inputs are used as the *S* and *R* inputs of the clocked FF. If you doubt this, then review the operation of the NAND gates.

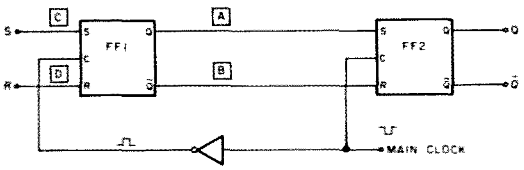


Fig. 4. Two RS flip-flops in a back-to-front configuration constitute a master-slave (M-S) flip-flop. This circuit allows only one output state change per clock pulse.

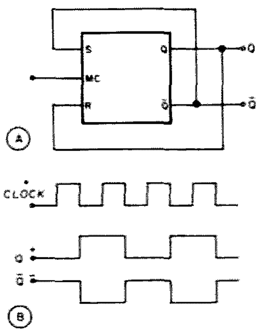
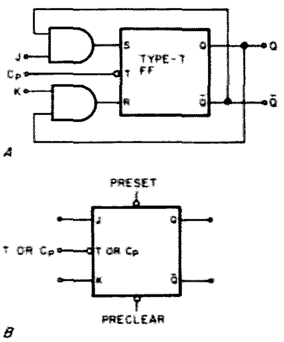


Fig. 5. (a) A type-T, or toggle, flip-flop is obtained by adding feedback connections to a master-slave flip-flop. This circuit acts as a binary divider. (b) For a toggle flip-flop, a negative-going transition of the clock results in a change of the output (Q) status.



J	K	CLOCK	Q Q̄
0	0		NO CHANGES
0	1		0 1
1	0		1 0
1	1		BINARY DIVISION

C

PRESET	PRECLEAR	CLOCK	Q Q̄
0	0	(DOESN'T CARE)	DISALLOWED
0	1		1 0
1	0		0 1
1	1		CLOCKED OPERATION

D

Fig. 6. (a) Two AND gates and a type-T flip-flop combine to form a J-K flip-flop. (b) Several designations (MC, T, or Cp) are used to indicate the clock input for a J-K flip-flop. (c) When both the preset and preclear inputs are HIGH, a J-K flip-flop is in the clocked mode. The output depends on the status of the J and K inputs. (d) Direct control of the J-K flip-flop is accomplished by using the preset and preclear inputs.

Master-Slave Flip-Flops

The use of clocking helps a great deal in taming the RS flip-flop, but several problems, again electronic versions of the old relay-race problem, still occur. Most of these are solved by using a slightly different approach—the so-called *master-slave flip-flop*. An example of the master-slave FF is shown in Fig. 4. This circuit allows only one output state change per clock pulse (the clocked RS FF allows continuous output state changes as long as the clock input is active).

The M-S flip-flop of Fig. 4 uses the clocked RS flip-flops of the previous example connected in cascade. The inverter shown allows us to drive the clock inputs of the two clocked RS FFs out of phase with each other.

Recall that the clocked RS flip-flop can change its output state only when the clock input is HIGH, and then only in response to conditions on the R and S inputs. In the M-S FF, the main clock is kept HIGH, so FF2 is active and FF1 is inactive.

When a clock pulse is applied (in this case a negative transition), FF1 will become active, and FF2 becomes inactive. Note that the effect of the inverter is to make the clock input of FF1 HIGH at this time. Any commands placed on the *S* and *R* inputs will cause changes in the outputs of FF1 (i.e., points A and B in Fig. 4).

But, because FF2 is inactive at this time (its clock input is LOW), changes at A and B are not yet reflected at the Q and NOT-Q outputs of FF2. But, once the master clock goes HIGH again, the clock input of FF2 goes HIGH again, so the changes that took place on A and B can be transferred to action at the Q and NOT-Q outputs.

The synchronization occurs by keeping FF2 inactive when the input stage (FF1) is being set up, and then rendering FF1 inactive (forbidding further *S* and *R* input changes from affecting the output), while transferring the data to FF2. This part of the sequence is called a *load-transfer operation*.

Additional Types of Flip-Flops

Thus far we have considered two versions of the RS flip-flop (NAND logic and NOR logic) and two flip-flops that are derivatives of the RS circuits, the clocked RS flip-flop and the master-slave flip-flop. In the sections to follow, we will consider some more complex types of flip-flop: *type-T* FF, *J-K* FF, and the *type-D* FF.

Type-T Flip-Flops

The type-T flip-flop (also called the *toggle FF*) is shown in Fig. 5. This FF circuit can be constructed by providing feedback connections (as shown) around an ordinary master-slave flip-flop. Recall that the M-S FF was constructed from a pair of RS FFs and an inverter stage. Note that the Q output is fed back to the reset input and the NOT-Q output is fed back to the set input.

The type-T flip-flop functions as a binary divider; that is, the output signal has a frequency that is one half (i.e., divided by 2) of the input signal. The timing diagram for this circuit is shown in Fig. 5(b). Note that the Q output changes state only on negative-going transitions of the clock pulse. At the first negative transition, the Q output will snap HIGH and remain HIGH until the clock input sees *another* negative transition. This condition occurs at pulse number 2, at which time the Q output goes LOW again. We have, therefore, binary division of the input frequency: One output pulse is produced for each two input pulses.

There sometimes are found differences in terminal designations from one text or spec sheet to another. In Fig. 5(a), for example, we have labeled the clock input *MC* for main clock. But it is likely that you also will see T for toggle, or C_p for clock.

J-K Flip-Flops

One of the most useful and perhaps most common forms of clocked FFs is the J-K flip-flop. There are several advantages to the typical J-K flip-flop. (a) There are no invalid or disallowed states in the clocked mode. (b) It can cause the outputs to complement. And (c), it can provide non-clocked operation (in some IC versions).

Fig. 6 shows one of several popular ways to represent the J-K FF. In this case, we see that it is a type-T FF with feedback to the set and reset inputs controlled by a pair of two-input AND gates. One input from each gate accepts the feedback lines, while the remaining inputs of the gates are used to form the *J* and *K* inputs of the FF, respectively.

Fig. 6(b) shows the circuit symbol for a J-K flip-flop.

Not all versions of the J-K will have the direct-mode inputs (preset and clear). These inputs do, however, make it a more useful device. The *preset* input may also be called a *direct-set* input, and the *preclear* input called a *direct-clear* input.

Direct mode operation. The operation of the J-K flip-flop in the direct mode is very simple, and it is independent of conditions applied to the J and K inputs. The direct mode is controlled only by conditions on the *preset* and *preclear* input terminals, and the rules are summarized in Fig. 6(d).

The direct mode inputs are active when LOW, so the only disallowed state occurs when both are simultaneously LOW.

If the preset input is LOW and the preclear input is HIGH, then the outputs immediately go to a condition where Q is HIGH and NOT-Q is LOW.

If the preclear input is made LOW and the preset input is HIGH, then the outputs go to a state where Q is LOW and NOT-Q is HIGH.

It is a general rule, when dealing with flip-flops of any type, that set or preset operations make the Q output HIGH and the NOT-Q output LOW, while clear and reset operations work in just the opposite manner (i.e., Q LOW and NOT-Q HIGH).

If both preset and preclear inputs are made HIGH, then the flip-flop is ready for normal clocked operation.

Clocked operation. Whenever the preset and preclear inputs (where used) are simultaneously HIGH, the J-K will operate in the clocked mode. The rules for clocked operation are summarized in Fig. 6(c).

Like the type-T FF, the J-K FF (in the clocked mode) responds on the negative-going transition of the clock pulse. No output changes will occur regardless of changes at the *J* and *K* inputs, until one of these negative-going clock pulse transitions is seen. The outputs will then respond according to the J-K input conditions. The rules for clocked operation are as follows:

1). If both J and K are LOW, then the FF is inert and does nothing. No changes will occur in the outputs.

2) If J is LOW and K is HIGH, then the clocking will make Q LOW and NOT-Q HIGH.

3) If J is HIGH and K is LOW, then the clock pulse transition makes Q HIGH and NOT-Q LOW.

4) If both J and K are HIGH, then the J-K FF behaves much like a type-T FF; clocking complements the outputs. This means that negative-going clock-pulse transitions force the outputs to go to the opposite state. The output waveform of the J-K flip-flop is then identical to the output waveform of the type-T flip-flop given in Fig. 5.

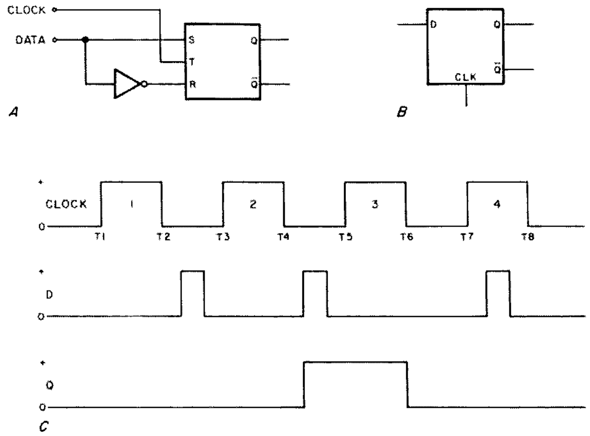


Fig. 7. (a) The type-D flip-flop is a derivation of the RS FF. (b) Symbol for a type-D flip-flop. (c) Data appearing on the D input is transferred to the Q output only when the clock line is HIGH.

Type-D Flip-Flop

The type-D or *latch* flip-flop is shown in Fig. 7. The equivalent circuit is shown in Fig. 7(a), while the usual schematic symbol is shown in Fig. 7(b).

The equivalent circuit consists of a clocked RS FF in which the set and reset inputs are fed by the same signal but are 180 degrees out of phase with each other (i.e., complementary inputs). An inverter between the *S* and *R* lines accomplishes this neat trick.

The common line to the reset-set-inverter is called the *data* or *D* input instead of clock. This input is usually labeled D on most schematics.

The rule for operation of the type-D FF is very simple: Data appearing on the D input will be transferred to the Q output only when the *clock* line is HIGH.

1) If the clock line is HIGH, then the output will *follow* changes in the input signal (i.e., changes on the *D* input). When the D line goes HIGH, then the output will go HIGH. Similarly, when the D line goes LOW, then the outputs follow by also going LOW.

2) If the clock line is LOW, then the output will retain the last data that existed on the D input at the instant the clock line dropped LOW.

These rules can also be seen in the timing diagram of Fig. 7(c). Read the description below, keeping in mind the two rules just given.

a) When the first clock pulse arrives (T1-T2), the D input is LOW, so the Q output also will be LOW.

b) During the interval T2-T3, the D input goes HIGH, but since no clock pulse is present, it cannot affect the output conditions.

c) At the beginning of interval T3-T4, clock pulse number 2 is HIGH, but the D input is LOW. The output, therefore, must remain LOW.

d)Approximately midway through clock pulse 2, however, the D input goes HIGH, forcing the Q output to also go HIGH.

e) The Q output stays HIGH even after clock pulse 2 goes LOW.

f) At the onset of clock pulse number 3, the D input is LOW, so the Q output drops LOW also.

g) The pulse on the D input during the interval T6-T7 cannot affect the Q output because the clock is LOW.

The so-called *data latch* device is a special case of the type-D flip-flop. This device is used in digital-readout circuits (e.g., in frequency counters) to hold current data until the new data has been updated and is ready for display. This gives the illusion that the data is updated instantaneously. In most cases, the clock input is called a *strobe* input. Data at the D input will be transferred to the Q output only when the strobe line is HIGH. The idea is to bring the strobe line momentarily HIGH when the data at the input is valid, and then let the strobe line go LOW again until the next newest data is ready.

And Now. . .

The third and final part of this series, to be published next, will allow you to wade into digital electronics up past your knees. The topics will be the most common multivibrator and counter circuits.■

Dissertation Upon Roast Pig

—the ultimate in surplus?

G. W. Legel N6TO
1306 Sheppard Drive
Fullerton CA 92631

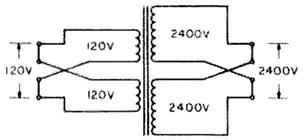


Fig. 1. 120-to-2400-volt connection.

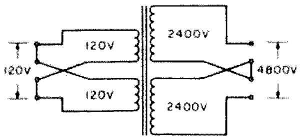


Fig. 2. 120-to-4800-volt connection.

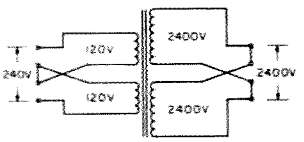


Fig. 3. 240-to-2400-volt connection.

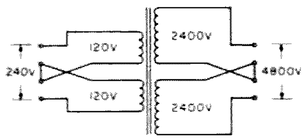


Fig. 4. 240-to-4800-volt connection.

This article is called "Dissertation Upon Roast Pig," with apologies to Charles Lamb, author of the essay with the same title. The poem was learned in high school literature class back in 1933, one year before I obtained my first amateur radio license (W9RTS). As you may remember, this was a comical poem which supposedly gave the origin of the succulent dish, roast pig. With regard to ham radio, roast pig refers to a much used, or roasted, transformer commonly known in amateur circles as "the pole pig." The dissertation is intended to bring a tear of joy to the eye of the old-timer, to acquaint the newcomer with the meaning of the term "pole pig," and to provide some technical know-how with regard to its use. Maybe some humor will creep in as well. First of all, what is a pole pig? Photo A shows a group of four. It is a distribution transformer which has for all intents and purposes served its useful

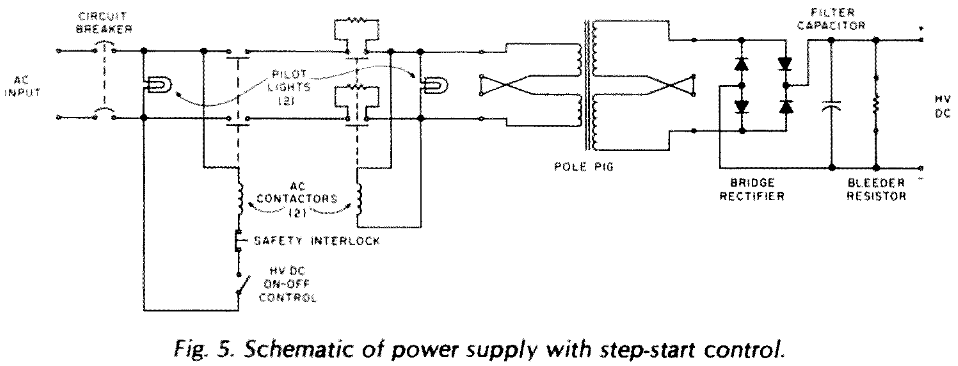


Fig. 5. Schematic of power supply with step-start control.

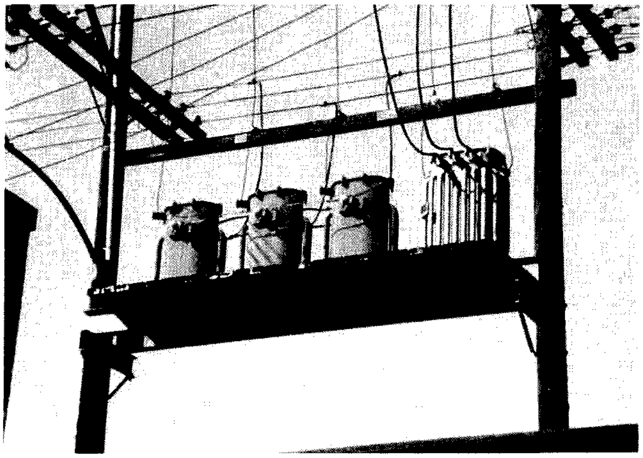


Photo A. A group of four pole pigs.

Photo B. Tools needed to procure a pole pig.

life and been relegated to the scrap heap. It has been used, or "roasted," for a long time by the electric power company for its primary purpose, that is, as a transformer which reduces the high voltage, as distributed, down to 120 volts each side of neutral for domestic use.

The term "pole" is taken from the fact that these transformers are usually mounted on a pole. The term "pig" is derived from the fact that, as amateurs are able to get them, they are unusually dirty and messy. They are completely saturated with transformer oil and have seen considerable use in power company service. They come in various sizes: 1, 3, 5, 25 kVA and larger. You will seldom see them larger than 50 or 100 kVA in your neighborhood. Of course, any transformer larger than 5 kVA is of no interest to us anyway.

Hams of long ago, and some to this day, used pole pigs to serve as the plate transformers in power supplies for their transmitters. The main reason that hams used them was the fact that they were cheap. About ten to fifteen years ago, they were available at electric company salvage yards for about $2.50 per kVA. They were, of course, used, but by judicious selection you could obtain a nice transformer for your plate supply.

In order to get a pole pig, supply yourself with a set of tools such as those shown in Photo B. Then go down to the electric power company salvage yard, identify yourself, and start off. Incidentally, I am told it is not so easy to do this as in times past. Well, anyway, meander around the yard, searching for the transformer of your choice. Photo C is typical of what you might expect to see. When you find one, give it the nose test. Smell it to make sure it is not burned out. A clever nose will find it easy to determine when a transformer is burned out. After making a choice, ask the yard attendant to drain the oil. Sometimes they are already drained, because the power company cleans and reuses the oil. After draining the oil, take hacksaw and cutting pliers and cut the leads going to the external terminals of the case. Following this, take the hammer and, with an old screwdriver serving as a chisel, remove the wooden wedges holding the transformer in the case. Then remove it from the case. If you are lucky, the yard attendant will help you do this, using a forklift, and then deposit the transformer into your car trunk or trailer. Incidentally, have plenty of rags and paper upon which to place it, since these transformers keep on weeping oil for months after acquisition. After you get it home, don't do anything to it for about six months except store it in a corner on a stack of newspapers to absorb the oil. This oil was used to cool and insulate these transformers in normal service, but is not required for intermittent amateur service.

Photo C. Possible candidates.

Now, having obtained a pole pig, and after allowing most of the oil to drain, let's see what it requires to put one into service. The next two photos show what was done with a 5-kVA, 4800-volt-to-240-volt unit.

Photo D is a front view with the high-voltage terminals toward you. Note that they are encased in red fiber tubing. These tubes have been cut down from their original length, since these terminals would stick up too high otherwise. Photo E shows the 240-volt terminals toward you. Note the larger solder lugs and also that the two center terminals are connected together, on both high and low voltage windings. More about the connections later. You may observe that this transformer is quite neat and has risen above the looks of the average pole pig. But then, let's use it.

Photo F shows a completed power supply assembled into a 22-inch by 30-inch by 40-inch roll-

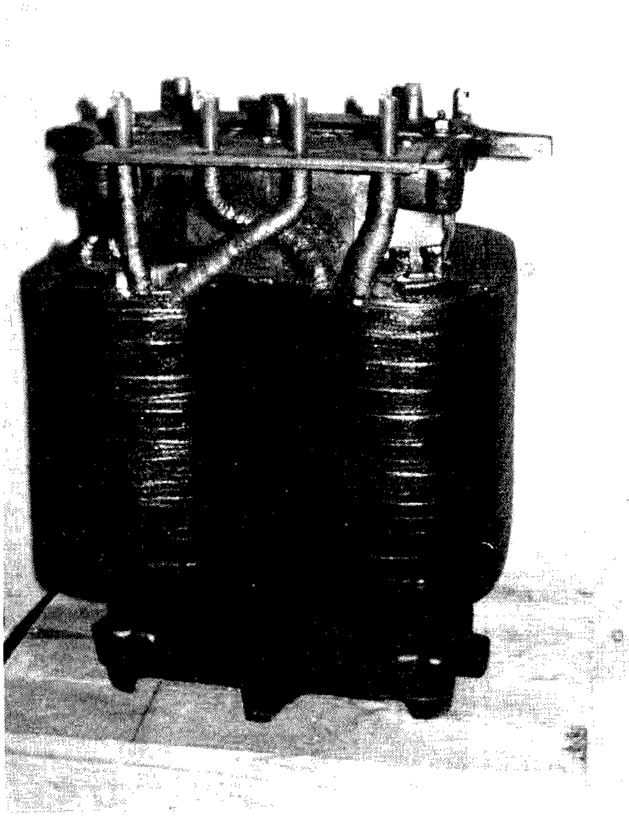


Photo D. Front view showing high-voltage terminals.

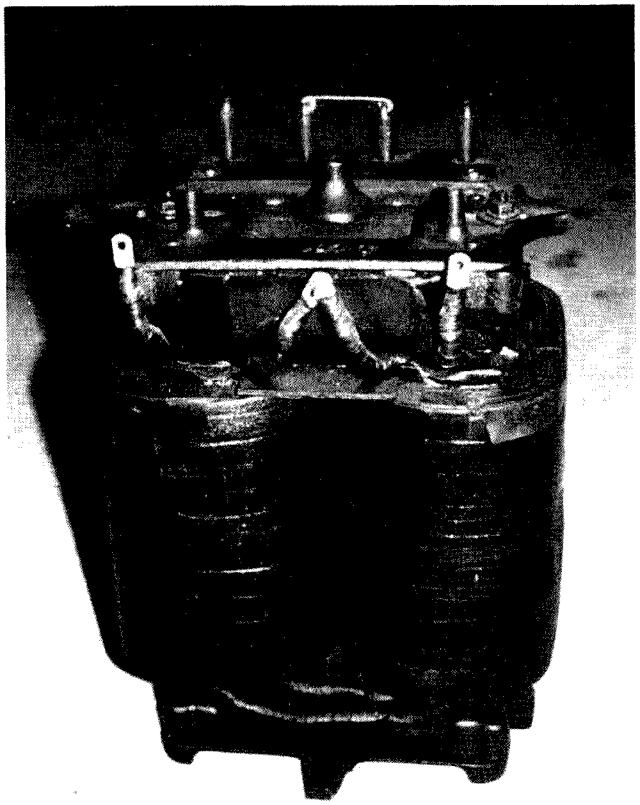


Photo E. View showing 240-volt terminals.

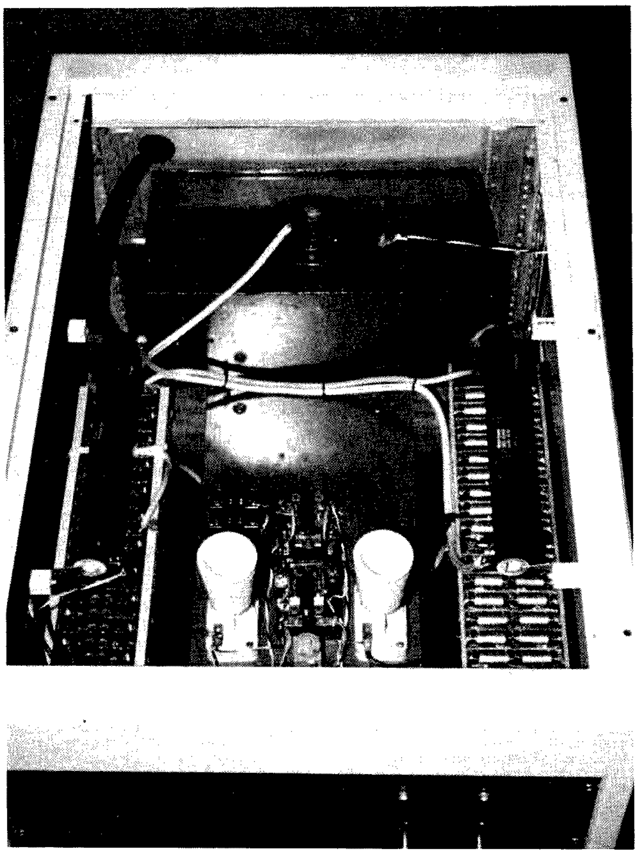


Photo F. Completed power supply.

around cabinet. A 0-to-240-volt Variac is used for controlling the dc output voltage from 0 to 5000 volts dc. The 5-kVA transformer can supply 1.5 Amperes with good regulation. Note the orange-colored device. This is a 10,000-volt-dc, 180-uF capacitor. Also, if you look closely on each side near the top, you can see the solid-state diode stacks and, immediately above them, the bleeder resistors. Note also the cone heaters and two contactors which will be explained later. This supply was designed to furnish power to a number of final amplifiers for contest work. The 180-uF capacitor and the 5-kVA pole pig are well able to supply the concurrent demands of several kilowatt amplifiers.

Photo G shows a 3-kVA transformer that represents an ideal size for a single high-power amplifier. It is in use in an amplifier using a 4-1000A in grounded grid. This particular one was dipped in black transformer insulating material, and when oven dried became a thing of real beauty. Yours truly is shown lifting it in Photo H.

Well, how do you connect a pole pig for use? The diagrams show the various input and output voltage connections. Note how the primary and secondary coils are strapped. All transformers of this type utilize two primary and two secondary windings for purposes of voltage changing. This first application shows parallel use of primary and secondary windings. Next, by connecting the secondary in series (Fig. 2), we obtain a 120-to-4800-volt transformer. The 4800-volt winding can be used either in a bridge connection or center-tapped. For a kilowatt amplifier, operating the power supply on 120-volt input is not recommended, since voltage drop

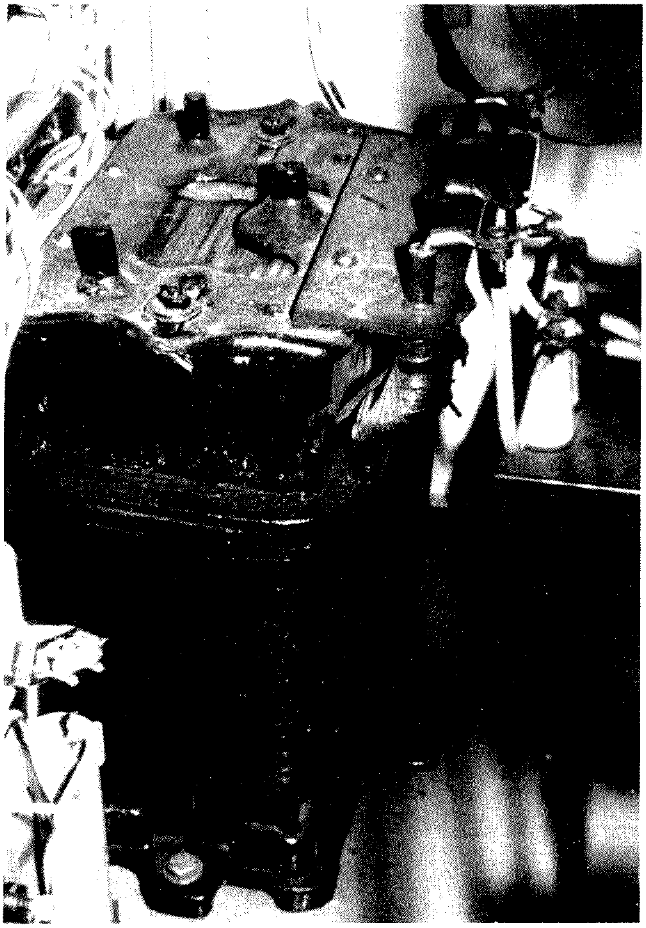


Photo G. A 3-kVA transformer, ideal size for a single high power amplifier.

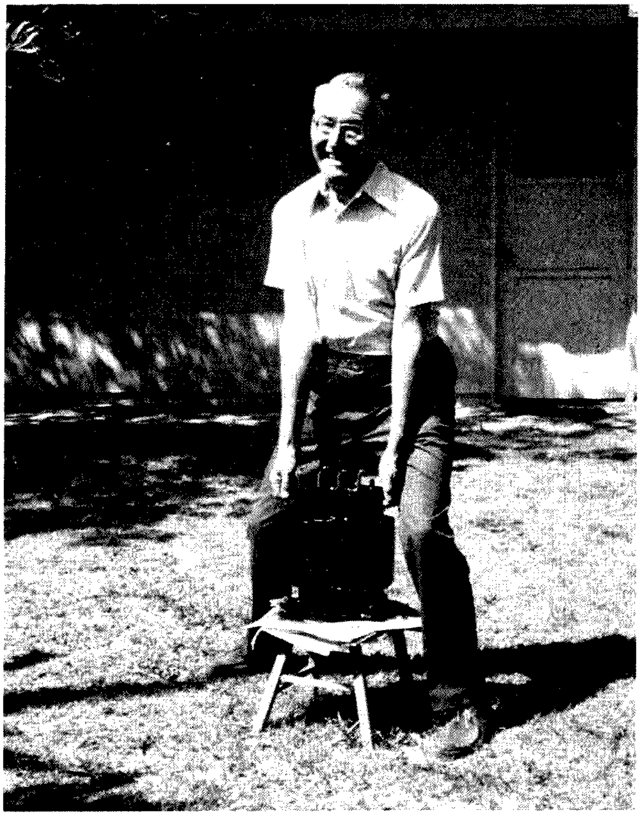


Photo H. The author lifting the transformer of Photo G.

on the primary input lines will be excessive, leading to poor regulation and efficiency.

Fig. 3 shows the connection for 240-volt input and 2400-volt output. Best use for this would be in a bridge circuit furnishing 2500 volts dc.

Fig. 4 shows the most widely used circuit. The 240-volt input is boosted to 4800 volts, which will provide 5000 volts dc in the bridge connection or 2500 volts dc in the center-tap full-wave connection.

For diode and filter protection, it is best to use a step-start circuit as in Fig. 5. This is where we use the cone heaters and the contactors. When the start switch is turned on, the first contactor operates, applying voltage to the transformer through the cone heaters acting as resistors. These limit the inrush current to a safe value for the diodes. After the filter has charged to a certain level, the voltage drop across the resistor decreases to a point permitting the second contactor to be energized. This contactor shorts out the resistors, thus permitting full voltage to be applied to the transformer. I heartily recommend the step-start arrangement. I have used it for years on supplies using 872s and solid-state diodes and never have had a failure due to excessive peak currents.

Finally, it is realized that not too much home-brewing is going on. But it is hoped that at least it may be interesting to many to become acquainted with the formerly much used pole pig.■

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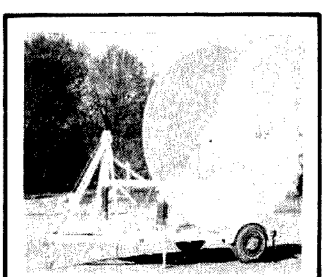

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Got an Apple? Want RTTY?

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After spending many years using various Teletype® machines and, most recently, a less-than-adequate video RTTY set-up, I finally decided to use my Apple II computer for this mode. I have owned my Apple for three years and have had the Chuck Galfo (WB4JMD) RTTY/CW software for two years.[1] The only thing lacking was the interface circuitry to connect the Apple to my ST-6 demodulator and HF/VHF radios. Galfo provides a sample interface in his software documentation, and Fig. 1 shows the block diagram of my final interface.

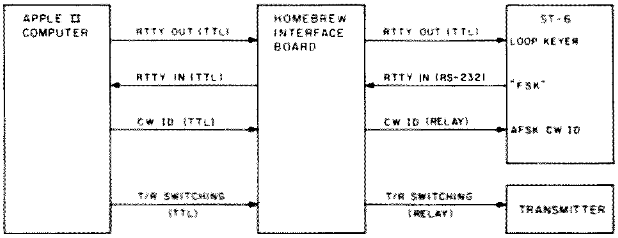

Fig. 1. Block diagram.

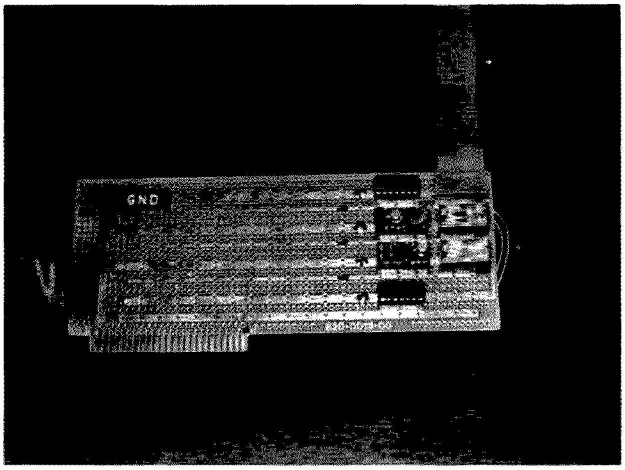

Fig. 2. The interface on an Apple prototyping board.

Interconnections to the Apple are made through the game paddle I/O port. The interface was built on an Apple prototyping board (Fig. 2) using wire-wrap; it is connected to the game paddle port through a 16-wire ribbon cable and to the outside world through a 12-pin molex® connector. The few transistors, resistors, and capacitors are mounted on two dip headers to simplify construction.

Fig. 3 is the schematic of my interface. TTL-level teletype transit pulses are available at pin 15 (AN0) of the game-paddle, 16-pin IC socket. To correctly key the loop keyer in the ST-6, these pulses must be inverted. This is done by one NAND gate of the 7404 IC. These pulses key the 2N706 transistor which in turn keys the ST-6 loop and the XTK-100 (or AK-1 depending on the age of your ST-6) AFSK oscillator for transmission of the audio tones. The 2N706 is mounted on a small PC board connected piggyback to circuit board #3 (active low-pass filter/slicer/keyer) in the ST-6. The interconnection point is indicated in Fig. 4.[2]

Received RTTY pulses are a little more difficult. The ST-6 provides both a 60-mA loop and "RS-232" (±20 V dc) pulses (FSK pin on the ST-6 rear panel). I chose to work with the FSK output, normally used to drive the FSK circuit in a transmitter, converting this signal to TTL logic levels required by the Apple using an MC1489 converter.[3] The TTL pulses are then routed to pin 2 (SW0) of the paddle port. The 6-pin AFSK-KEY/FSK-KEY molex connector on the rear panel of the ST-6 becomes the Apple's connection point. Since I use AFSK I have no need for the "FSK" circuit keying pulses; I removed the molex pin and replaced it with the line

running to the 2N706 keying transistor.

CW ID is available at pin 13 (AN2) and keys the simple relay circuit. Transmit/Receive switching signals are outputted to pin 14 (AN1) and key an identical relay circuit as the CW ID function. T/R status is indicated by two LEDs as shown. Rather than modifying the Apple case, I mounted these LEDs in a small box and attached it to the Apple using a Velcro® strip (Fig. 5).

Operating voltages are available from the Apple power supply and appear on the prototyping board. Plus 12 V dc to operate the relays is found on pin #50 of the prototyping board. Galfo recommends that all lines entering and exiting the computer be bypassed to ground with small (200-μF) capacitors. The prototyping board documentation recommends that all voltages on the board should be decoupled with a 0.1-μF capacitor to ground near the I/O connector board pin. Do NOT use high-value electrolytic decoupling capacitors as they can cause improper operation of the Apple power supply. I highly recommend these bypasses, although I have run a kW on RTTY without them and have experienced no glitches.

A few words of caution at this point are appropriate. First, as you can see from Fig. 6, the interface board is mounted in slot #7 of the Apple and is next to my disk controller board. Since I used wire-wrapping, the component side of the interface board faces the component side of all other peripheral boards. I placed all of the wire-wrap sockets at the end closest to the keyboard. If I were to reproduce the board again, I would move the 16-pin connector going to the ST-6 to the same end as the components to preclude any interference with the disk controller board. Second, be sure that you *always* turn the power off to the computer before inserting or pulling out the interface or any other board! All cables connecting the Apple to the outside world should be shielded. I used microphone cable (two conductors plus a shield) for those lines and tied them together using small tie-wraps to form a neat cable.

Galfo's software is outstanding. It allows you to transmit and receive Baudot and ASCII at all the popular speeds and, in fact, will operate at any baud rate between 32 and 300 baud. Split screen, automatic CW ID, prepared messages, and automatic T/R switching make operating a real pleasure. When I purchased the program it came on cassette tape, but it can easily be transferred to disk and, as careful inspection of the basic program listing shows, the disk commands to BLOAD the machine language routines are already present.

I turned my RTTY diskette into a turnkey system by making the Integer BASIC program the "HELLO" program. So all I have to do is pop the diskette into the disk drive, turn on the Apple, and the system will automatically come up with the five prompts required to initiate RTTY operation. One last caution: When the computer is on but the RTTY software is not in use, the T/R line is held in the transmit condition. Therefore, if you have your transmitter turned on it will be keyed. To fix this I simply installed a switch in the T/R line to disable this function when both the computer and my transmitter are in

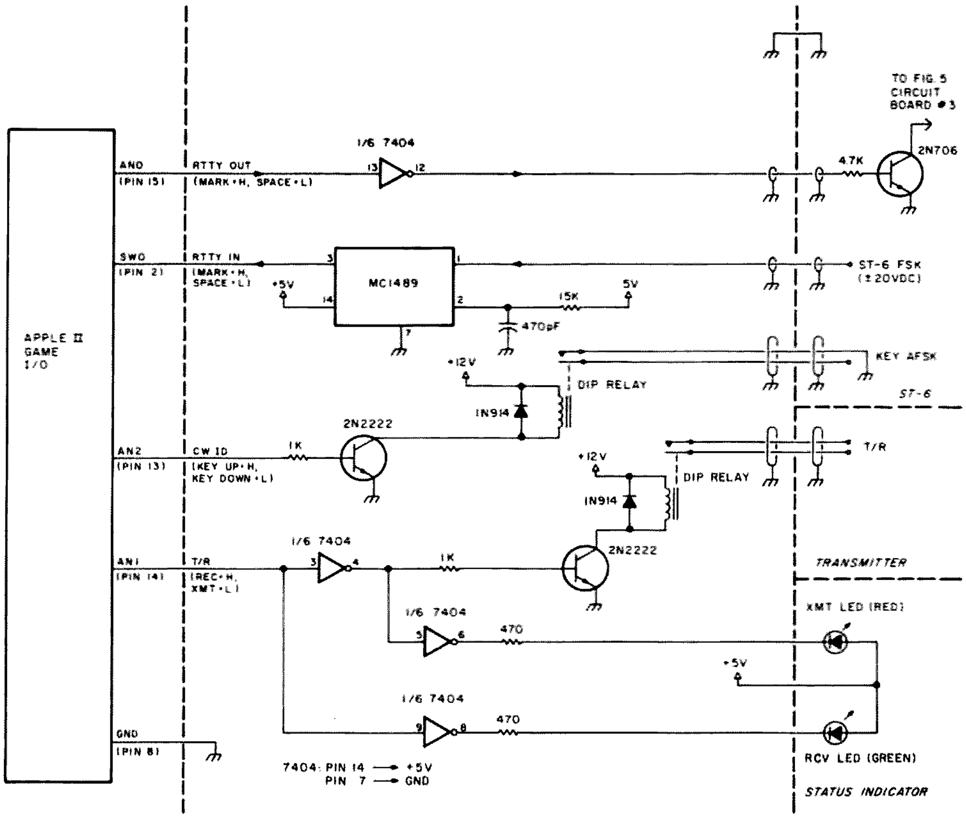

Fig. 3. Interface board schematic.

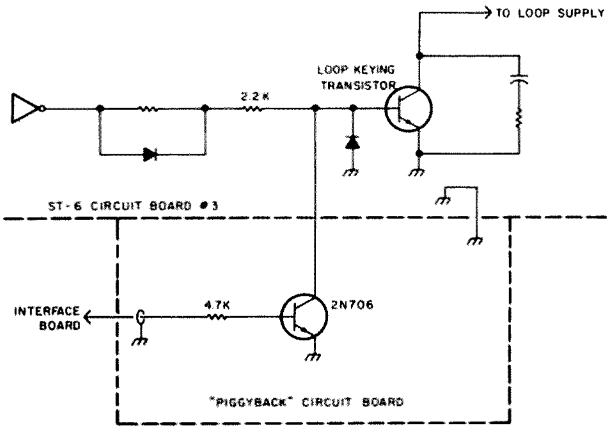

Fig. 4. ST-6 transmit keying point.

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34620 LAKELAND BLVD EASTLAKE OH 44094
(216) 951-2110

Parts List

ICs/Transistors/Diodes
- 1—7404
- 1—MC1489
- 2—2N2222
- 1—2N706
- 2—1N914

Resistors/Capacitors
- 1—15k
- 1—4.7k
- 2—1k
- 2—470 Ohm
- 1—470 pF

Miscellaneous
- 1—Apple prototyping board
- 2—LEDs (1 red; 1 green)
- 2—12 V dc subminiature DPDT relay (Radio Shack #275-213)
- 1—6-inch, 16-wire ribbon cable with 16-pin IC plugs
- 16-conductor ribbon cable
- 12-pin molex connectors
- Wire-wrap sockets

use but not in the RTTY mode.

Computer RFI is a problem that has received a lot of attention lately. I am happy to report that the Apple (at least *my* Apple) does not affect my HF or VHF rigs at all. It does manage to tear up TV reception in the shack though!

Galfo's software package will also transmit and receive CW, but I have yet to build that interface. There also is a new, disk-based version of this package. It provides logging and the ability to send and receive BASIC programs, but I have not purchased it as yet.

The interface can be built for less than $50 (including the $24 for the prototyping board) and most of the parts were bought at Radio Shack. The software is available for $20-$30 depending on which version, cassette or disk, you want.

Considering the price of commercially-available interfaces, this is a powerful yet simple (and cheap!) method to put your Apple to use in your RTTY station. The interface should be adaptable to just about any other TU with minor modifications. I would be happy to answer any questions and will welcome any comments or suggestions. Please enclose an SASE with all correspondence. See you on the green screen. ■

References

[1]RTTY/CW software available from C. H. Galfo WB4JMD, 6252 Camino Verde Drive, San Jose CA 95119, or Rainbow Computing, Inc., Mail Order Dept. No. CC11, 19517 Business Center Drive, Northridge CA 91324; (800)-423-5441 (except CA); CA and foreign, (213)-349-0300.

[2]*The New RTTY Handbook*, edited by *73 Magazine* Staff, Chapter XI: Accessories.

[3]"Cross Pollinating the Apple II," Richard Campbell, *Byte*, April, 1979.

Fig. 5. LEDs box attached to the Apple's case with Velcro.

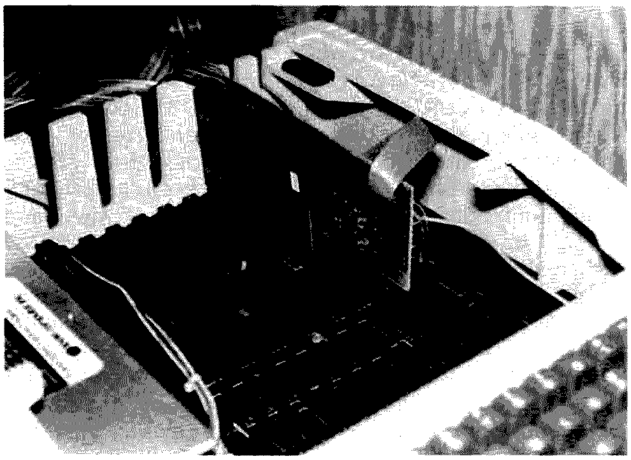

Fig. 6. The mounted interface board.

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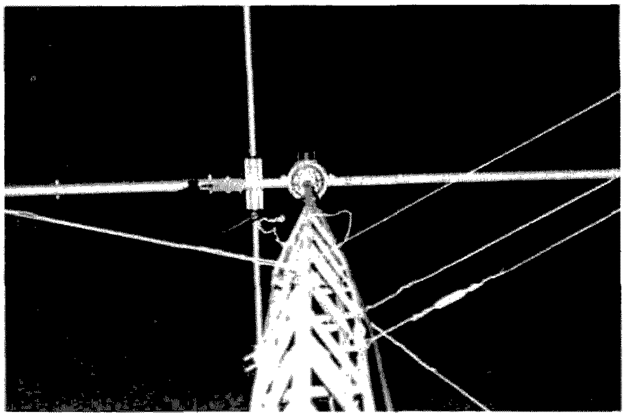
The Pleasures and Perils of Crankup Towers

—don't lose your head!

A tower is well known as one of the most beneficial station accessories an amateur may own. Standing as an outdoor monument to our superb world of long-distance communications and international friendships, the amateur's tower supports that final and most important link in his setup—the antenna. The height of such towers is usually a compromise influenced by cost, self-serviceability, and neighborhood acceptance.



A triband beam on the crank-up tower nestles in its fully-retracted position awaiting the impact of an approaching late-night storm. The photo was taken at midnight with flash and 400 ASA film.

Recently, the somewhat limited in height but highly versatile crank-up tower has gained renewed interest in amateur circles. This article will present some vital information concerning crank-up towers so that the reader may be made aware of their favorable and unfavorable aspects. In some situations, this information may provide new light for cliff-dwelling amateurs. In other situations, this information may help prevent serious personal injury to unsuspecting owners of crank-up towers. This is not to imply that crank-up towers are excessively dangerous, but rather to remind that there are right and wrong ways for using these antenna supports.

The Pleasures

Zoning laws and neighborhood restrictions are affecting an increasing number of radio amateurs each day. Unfortunately, it's becoming more and more difficult for amateurs to erect a simple triband beam on a reasonably-sized tower (40 to 50 feet). Quite often, this problem is solved with the aid of a crank-up tower mounted out of view behind a house. The antenna may thus be raised above roof level only during periods of actual on-the-air use. Additionally, if this activity is confined to night hours, darkness can cloak the raised array.

Many amateurs are not able to climb towering heights (no pun intended!) and must forego antenna tuning or repairs until a

suitable "antenna party" can be organized. Crank-up towers, however, may be erected initially against the side of one's house, and future changes or repairs may be made by the amateur while sitting or standing on his roof. If the tower is secured to the house, it may be used as a ladder to access the roof. Warning: Never climb a crank-up tower that isn't securely lowered to its resting position. An inside section could slip and break an arm, leg, or foot.

Adequate guying is another sensitive area of tower installations. Many times, upper level guys require more real estate than an amateur can provide. Limiting reasons range from guy wires obtrusively crossing established boundaries to unwarranted TVI complaints from neighbors. Two-section crank-up towers which are raised to full height only during use need to be guyed only at roof level (near the top of the lower section).

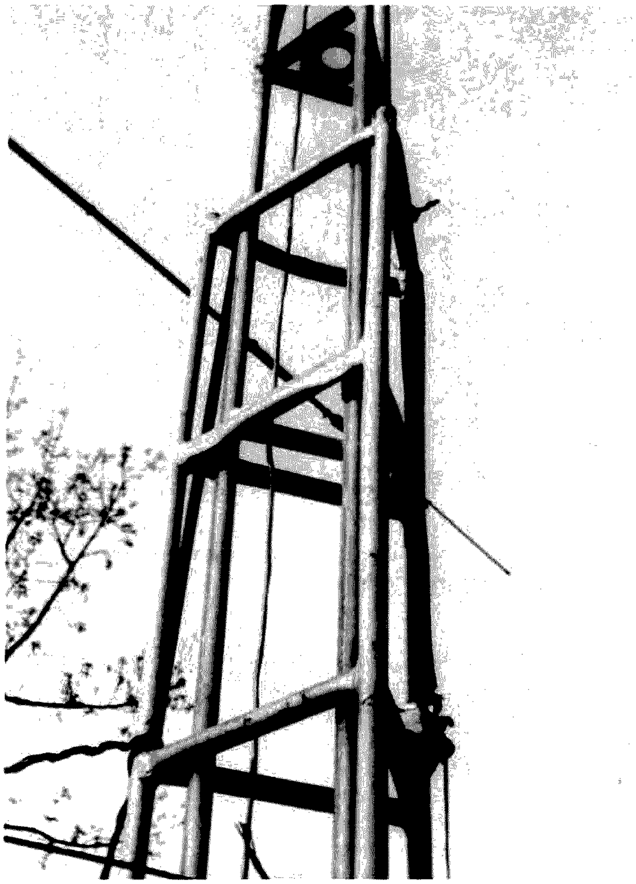
The wind-load rating of a lowered crank-up tower is much greater than a comparable full-height tower. Here in Alabama, for example, our crank-up tower and triband beam have "rode through" many extreme storms and tornado side-effects with no damage while smaller towers and antennas have been totally destroyed. (But I'd better not brag!)

Crank-up towers maintain a relatively high resale value; consequently, many amateurs secure these towers to their house and guy them at one level. The bottom section is then placed in one or two feet of dirt. This method permits the tower to change locations with the amateur, rather than being left behind in a massive pillar of concrete.

The mental (and sometimes physical!) security obtained by lowering your towering giant of an antenna to mere roof level as a violent storm approaches is sheer bliss. I speak from experience. Have you ever run out during a hailstorm and started replacing snapping guy wires as a tornado passes within a few miles of your home? Have you ever wrapped the aforementioned guy wires around yourself and held onto a swaying tree only to see your three-element quad become a rotary loop? Yes, crank-up towers are a blessing for the less-than-stout-hearted amateur!

How Crank-Up Towers Work

A crank-up tower consists of one or more concentric sections which move vertically on track guides within lower sections. An aircraft-type flexible cable is affixed to the smaller inside section's bottom rung, passed through a pulley near the top of the larger outside section, and fed down the tower's outer side to a winch mounted a few feet above the outside section's bottom end. As the pulley cable is reeled onto the winch, the tower's inside section is raised up toward the outer section's top-mounted pulley. A safety latch, or ratchet, is included near the outer section's top to prevent accidental down-plummeting should the operator let go of the winch crank. The latch is secured with a spring, and a control line extends downward so that it can be operated from the cranking position.



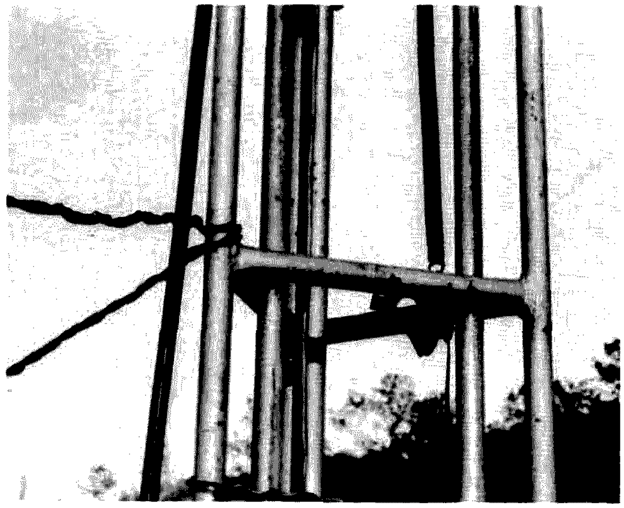
A safety-latch system used with many crank-up towers is shown here. A spring, fastened to the top rung of the lower (outside) tower section (see tie-wire projecting out to the right), extends down to and holds firm the "C" latch, here engaged with the third rung down of the outer section. The latch can be disengaged by the safety line, here extending downward from the latch, and when the inner section is cranked up about two inches, it then can be lowered past the outer rungs. Should the operator let go of crank and safety line, the spring will slam the safety latch back in position to engage the next rung down.

The Perils

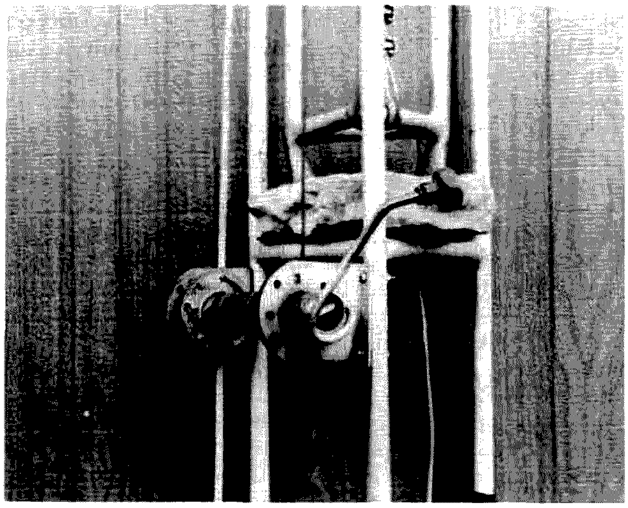
An improperly operated or unmaintained crank-up tower may, in some respects, resemble a modern guillotine. If a small, inside tower section which is weighted at its top with a triband beam uncontrollably falls straight down, it easily can sever a hand, arm, or foot which might be in its path of travel. Never rely solely on safety latches or catches for protection, and never allow any part of your body to get into a raised tower without foolproof safety backups such as concrete chocks between sections.

Assume, for example, a wasp surprise-attacks you as you're cranking a tower. If you inadvertently let go of the winch, it may rapidly unwind and crack your wrist or rib in a split-second's time. If this same tower isn't perfectly plumb, rungs on the inner section can jump the safety latches and the guillotine effect is created. Assuming you manage to get clear of the plummeting tower, the sudden stop at the bottom (fully retracted position) can snap beam elements or boom supports.

These perils can be reduced to a minimum by periodically ensuring that all safety latches operate properly, that their springs maintain ample latching pressure, *and* that additional fall-limiting chocks on raised crank-up towers are used. Ratchet teeth on the



Another view of the safety-latch system. The "C" latch is held in the rung by the spring. The safety line can be seen extending down from the latch.



This is the working position of the crank-up tower. Note the use of the solid chock across the rungs, preventing the inner section from descending further. Visualize this chock being replaced with a hand or arm and a cable breaking. Obviously, safety should be a priority consideration for crank-up tower owners.

cranking winch should also be maintained in sharp, toothy condition to prevent winch-handle cartwheeling. Inspect all latches and springs periodically to ensure that rust and/or corrosion isn't hampering their operation.

As an additional safety measure, an amateur might place a concrete or steel chock above the "working position" (winch location) to prevent personal injury should a cable snap during cranking. Also, an auto's front wheel spring can be placed inside the larger tower section at ground level to cushion any accidental inside section drops.

Occasionally, an amateur may raise his crank-up tower slightly higher than suggested by the manufacturer. If the tower is leaning 3 or 5 degrees from perfect plumb, the upper section can tilt and become stuck at this height. Hmmm—a cocked guillotine!

First, never raise an unplumb crank-up tower to a point where over one-third of the moving section is above its larger lower section. If, however, such misfortune does occur, the amateur must cautiously free the off-center stuck section. Double-chock the tower's upper and lower sections to limit the freed section from falling more than a couple of inches. Then, assuming the tower is resting against the house roof or side, climb atop the house (via a ladder, not via the tower!) and gently straighten up and reinsert the upper section while an assistant keeps pressure on the winch and controls the safety-latch line. This is not a difficult maneuver; it merely requires caution. I've done this single-handed by keeping pressure on the winch while pushing the moving section back straight and then slowly unwinding the cable (and lowering the upper section). I wouldn't care to try this daredevil stunt very often, however.

It's possible that an unexpected killer storm can arise during that once-a-year occasion when an amateur forgets to lower his crank-up tower. Sorry 'bout that (maybe my next article will describe tower straightening techniques). Plan ahead. Either install permanent guys and chocks, seldom lowering your tower, or make tower-lowering part of your amateur activities. A properly maintained tower can be raised or lowered within 2 or 3 minutes, and it's great exercise!

Some of the smaller crank-up towers do not have room inside their top sections for mounting large rotors. Consequently, the rotor must be mounted above the top section. Wind force in this case will be directed against the rotor rather than the tower, since a thrust-bearing arrangement cannot be utilized. Assuming a relatively large rotor and reasonably-sized beam are used, few problems need be expected, particularly if the tower is retracted to minimum height during periods of non-use. In other words, pick your antenna and rotor size according to your use and future plans—and don't overrate their capabilities. A 40-dollar rotor mounted atop a tower can't handle a full-size 20-meter beam!

Crank-Up Tower Maintenance

Crank-up towers, like any mechanical devices, require occasional maintenance for reliable and long-term operation. Basically, this maintenance consists of oiling tower sections at points of friction, oiling the pulley(s), cable, and winch bearings, plus oiling the safety clamp(s) and tightening springs as necessary. Regular 20- or 30-weight auto oil is perfect for this application. A few drops placed at the top of each section's corners will slowly run down the section's length and spread into its runners. This procedure may also be applied to the pulley cable. Finally, guy wires can be rechecked and their turnbuckles adjusted as necessary to maintain exact plumb.

Conclusion

Assuming that safety and maintenance rules are diligently respected, the crank-up tower should prove a cherished accessory for any amateur. Limited height, two-section crank-ups are extremely useful for antenna experimenters or amateurs faced with structure limitations. The beauty of variable-height, accessible support is hard to beat, but don't overlook safety precautions. Antenna accidents are the leading cause of injuries to today's radio amateurs. ■

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The Incredible Antenna Mark 2

—a complete HF allbander in a very small space

Seven years ago I wrote an article titled "The Incredible 18-Inch Allband Antenna" (*73 Magazine*, March, 1975). Since that time there have been many variations built. The original antenna had some severe intermodulation problems which made extra signals appear just where you did not want them. My project was satisfactory for locations far from other radio stations, but not good for cities. The Incredible Antenna Mark 2 solves these problems.

The antenna is remarkable because it covers the entire shortwave band from the AM broadcast band up through the 10-meter band and is compact enough to sit on top of any receiver.

This antenna functions very differently from ordinary antennas. Imagine for a moment that any two conductors in the universe form the plates of a capacitor. If they are an inch apart they form a capacitor, and if they are 1,000 miles apart they still form a capacitor. Naturally, the impedance of a capacitor with a 1,000-mile spacing is going to be very, very high. So what we want to do is build a very, very high input-impedance, active-circuit transformer to convert down to normal transmission-line impedances. If a little amplification is done at the same time, so much the better.

Photos by Carroll Haugh

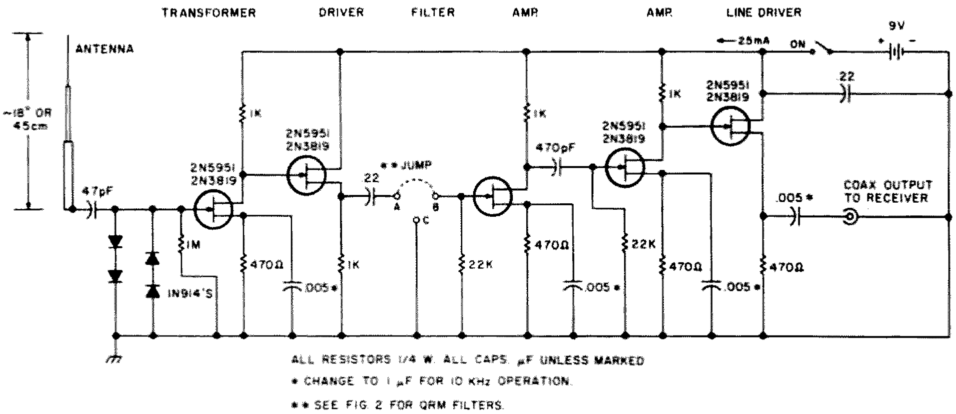

Fig. 1. Schematic for the 18" allband antenna.

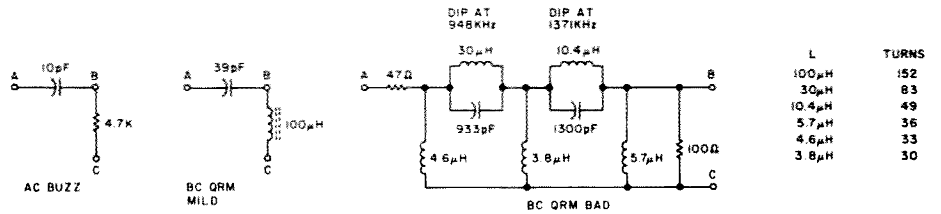

Fig. 2. QRM filters. All coils are ¼" diameter and ¼" long. Use #30 or smaller enamel wire.

The amplification of the improved antenna system shown in Fig. 1 is done by common rf field-effect transistors. Using FETs made a great improvement in the spurious signals. Note the terminals marked A, B, and C. These are for insertion of filters to remove local broadcast stations. Try jumpering A and B together first. If interference shows up, then add the appropriate filter from Fig. 2.

As for building the Mark 2, I used all common disc-ceramic or mylar™ capaci-

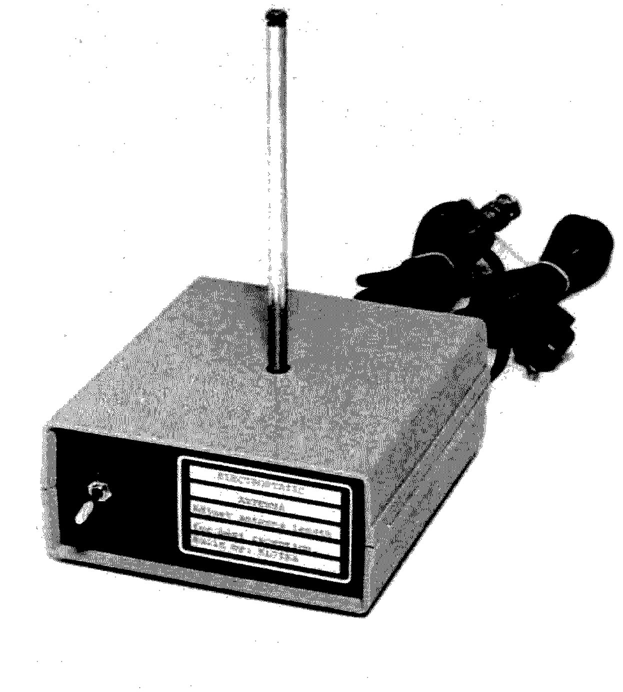

Photo A.

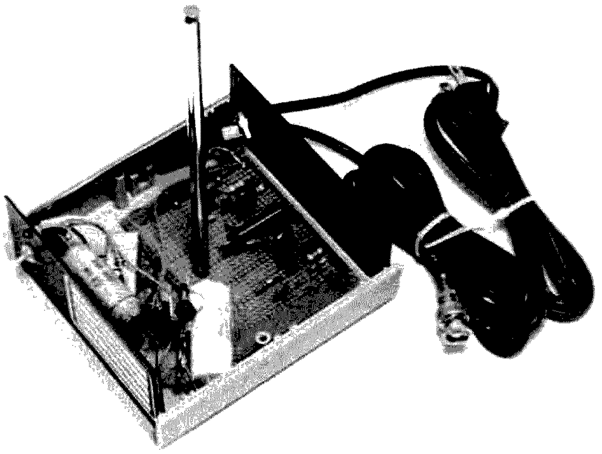

Photo B.

tors, carbon-film resistors, and FETs purchased from the local Radio Shack store. (I recommend 2N5951 FETs if you can get them, but 2N3819s do work.) All of this is mounted on perforated phenolic board. Leads should be kept short as is conventional in rf practice, and I used a number 18 AWG wire to form the ground bus. Make sure that there is as little capacity between the antenna rod and ground as possible. Don't use coax between the board and the rod; use an old-style ceramic feedthrough insulator for the rod or at least a large plastic support to keep the ground capacity low. I found that a replacement-type antenna designed for a transistor radio was ideal because it allowed me to adjust antenna length to reduce local interference.

If you are wondering about adding a power supply, watch out for electrostatically-induced hum. The voltage can be anywhere between 9 and 14 volts, but it is necessary to bypass the ac line to the antenna ground or, even better, use a wall-mount, calculator-style power supply. Internal power supplies will require that you shield the transformer and power line. If this is not done, then you will have CW signals modulated by ac hum. The easiest power supply is a good 9-volt battery.

Last time I wrote about the antenna, some low-frequency SWLs wanted to know if this would work all the way down to 10 kHz. The answer is yes, but only if the .002-uF capacitors are changed to 1 uF. Naturally, it becomes much more prone to power-line noise when you do this, and I don't recommend it unless you need the additional coverage. Using a very narrow-band receiver, I have been able to receive a Ft. Collins, Colorado, audio frequency station, but it was only marginal on an 8-foot rod.

I figure this project will cost $25 and two evenings, one to get the parts and another to build the antenna. It will open the lower frequency ham bands and the international shortwave bands to everyone with a receiver. I'm already working on the next version for use in my car with an integral noise blanker. ■

Parts List

1—1 megohm, ¼ W
2—22k Ohm, ¼ W
4—1k Ohm, ¼ W
4—470 Ohm, ¼ W

1—47 pF ceramic
1—470 pF ceramic
4—.005 μF ceramic
2—.22 μF (272-1070)

5—2N5951 (preferred), or 2N3819 (276-2035)
4—1N914 (276-1620)

1—Switch, SPST (275-324)
1—9 V battery or power supply
1—Battery holder (270-326)
1—Perfboard (276-158)
1—Battery snaps (270-325)
1—Box, plastic (270-218)
1—Antenna replacement (15-232)

(Radio Shack numbers given.)

If you really want to figure out how much capacitance there is between two identical rod antennas, then solve the following simplistic equation for a 10-cm spacing, and then for a 100-km spacing. For the academically inclined, the results are worth the effort. With L = length of wires in meters, D = spacing in meters, r = wire radius in meters, and C = capacity in pF, then

$$C = 17.7\pi L \left\{ \mathrm{Cosh}^{-1}\left[\frac{D^2 - 2r^2}{44}\right] \right\} - 1$$

Where: $\mathrm{Cosh}^{-1}x = 1n\,[x + (x^2 - 1)^{1/2}]$

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The Amazing Beam Header

—point it with your Pet

Many of us have beam antennas we use for working DX stations. As you probably are aware, the rotatable-beam antenna is of little advantage unless you know where to point it to work a given station or country. There are maps available which can be used for ballpark estimates of the headings, but I find that these usually are centered somewhere else besides where I am.

I have one of these maps, but I find that to use it I first must determine what country the station is in and then locate the country on the map. The problem is that while I usually hear the DX station call, sometimes I never hear what country he is in; by the time I find the prefix in a country list and locate the country on the map, either the band folds or the station moves on. If you operate a fast-paced contest, you do not have the luxury of taking more than a second or two to point the beam.

It was during one of those contest weekends that I looked over at my Commodore Pet microcomputer and asked myself, "What if . . . ?" What if I loaded a cross-reference list of call prefixes and countries into the computer so it could look up any call prefix and tell me what country it is in? What if I also loaded the latitude and longitude of the country into the computer? Then I could just type in the call prefix and have the microcomputer calculate the proper beam heading.

From that point on, the contest was a total loss. I spent the rest of the weekend (actually the next two weeks of my spare time) on the microcomputer, working on a beam-heading program.

The idea of writing a beam-heading program had crossed my mind a time or two before, and already I had definite ideas of what I wanted. Naturally, I wanted to be able to input a call prefix and get back a beam heading to that call area. As an extra, it would be nice for the computer also to tell me what country I am working. Some call areas are rather large, and the beam heading for one city may be significantly different from that for another city in the same area. So it would be nice if the computer also would give me several cities within a given large country or call area (such as Canada or Mexico).

I work mostly SSB, and many of the phone stations in the US and Canada will give their city and state when they call CQ, so it would be nice to have a look-up by city and state or province. Since I have a printer connected to my computer, I wanted to be able to dump a list of all locations with headings to each. If I had an option to change my location (the location the beam headings would be calculated from), I could run lists for friends in other cities.

The program listed with this article is what I ended up with. It begins by reading the data on each city. This data is illustrated beginning on line 5000 and includes the call prefix, city (and state or province for the US and Canada), country, and latitude and longitude. As you add or delete cities in the data, be sure to put the correct number of cities on line 110. The variable N is used throughout the program in loops to save having to change every loop each time you add or delete a city. A 16K Pet will hold data for about 150 cities. You can get latitude and longitude data from an almanac or a good atlas.

Once the cities are all loaded, the program must obtain your latitude and longitude. It does this by asking for your city and state and looking it up in the data. (Input your city followed by the two-letter abbreviation for the state; do not put a comma between the city and state.) If it cannot find your city and state, it will

```
                CHOOSE AN OPTION

0.  FIND BEARINGS TO GIVEN CALL PREFIX
1.  FIND BEARING TO GIVEN CITY
2.  FIND BEARINGS TO GIVEN COUNTRY
3.  PRINT BEARINGS TO MAJOR U. S. CITIES
4.  PRINT BEARINGS TO MAJOR CANADIAN CITIES
5.  PRINT BEARINGS TO MAJOR FOREIGN CITIES
6.  PRINT BEARINGS TO ALL MAJOR CITIES
```

Fig. 1. This is the menu of options available in the beam-heading program. The options which say "find" will print on the video screen. The options that say "print" direct their output to the printer.

ask you if you want to try another city. If you answer no, it will then ask for you to direct-input your latitude and longitude. From here on out, the program is menu-driven. The menu is listed in Fig. 1. There are seven options in the menu, including four print options and three screen options. For each option, the program searches the data based on the given key (prefix, city, country) and prints or displays what it finds. A sample of what you get on the screen from option 2 is shown in Fig. 2.

If you answer yes when the program asks if you want the data sorted by call prefix (a good idea if you are going to use the printing options), be prepared for a little wait if you have very many locations to sort. I do not pretend to be an expert in sorting, and I did not write this sort in machine language—which would have been faster but more difficult to adapt to different computers. At any rate, it will take a few minutes to sort if you have a hundred or more locations in the data.

What the program must do is find the initial heading for a great-circle route between your QTH and each city in the data. The equations in *The ARRL Antenna Book* turned out to be of little use for me in this program. The problem I had with the ARRL equations was that I needed to take the arc cosine of the angle. My microcomputer's BASIC has only the arc tangent. For the solution to this problem, I went to my trusty math handbook and found a set of equations called Napier's Analogies. The algorithm I developed from this is on lines 1000 through 1320 of the program. It was thoroughly tested before I put it into this program and it works for any two points on the globe.

For those of you who may want to put this program on a microcomputer other than a Commodore, let me mention some small details. First, the CHR$(1) in the heading print subroutine (lines 4000-4140) tells the printer to enhance the print on that line. (A sample page

Program listing.

```
10 REM *************************
20 REM * BEAM HEADING PROGRAM *
30 REM * BY DAVID C SWAIM II  *
40 REM *      AUGUST 1981     *
50 REM *************************
100 POKE 59468,12
110 N=12
120 DIM P$(N),M$(N),C$(N),LA(H),LO(N),S(N)
130 PRINT"                    LOADING"
140 FOR I=1 TO N:READ P$(I),M$(I),C$(I),LA(I),LO(I):NEXT I
150 INPUT"  WANT IT SORTED BY CALL PREFIX";AN$
160 IF LEFT$(AN$,1)="Y" THEN GOSUB 8000
170 INPUT"INPUT NAME OF YOUR CITY AND STATE ";CY$
180 GOSUB 7000
190 IF F>0 THEN 250
200 PRINT"YOUR CITY WAS NOT FOUND IN MY LIST. WANT TO TRY ANOTHER CITY   ";
210 INPUT"";AN$
220 IF LEFT$(AN$,1)="Y" THEN 170
230 INPUT"LATITUDE OF YOUR LOCATION (SOUTH IS NEGATIVE)";V1
240 INPUT"LONGITUDE OF YOUR LOCATION (EAST IS NEGATIVE)";H1
250 GOSUB 2000:REM PRINT MENU
260 IF LEFT$(W$,1)=" " THEN 170
270 PRINT""
280 IF W=0 THEN 340
290 IF W=1 THEN 500
300 IF W=2 THEN 630
310 IF W<0 OR W>6 THEN 250
320 GOSUB 3000
330 GOTO 250
340 REM LIST ON SCREEN BY PREFIX
350 PRINT"ENTER CALL PREFIX    ";
360 INPUT"";PF$
370 IF LEFT$(PF$,1)=" " THEN 250
380 PRINT"                 BEARINGS FOR CALL PREFIX ";PF$;""
390 CP=0
400 FOR I=1 TO N
410 IF PF$<>P$(I) THEN 460
420 CP=1
430 V2=LA(I):H2=LO(1)
440 GOSUB 1000
450 PRINT M$(I);"  ";C$(I);TAB(30);A
460 NEXT I
470 IF CP=1 THEN 340
480 PRINT"UNABLE TO LOCATE PREFIX ";PF$
490 GOTO 340
500 REM LIST ON SCREEN FOR GIVEN CITY
510 PRINT"ENTER CITY NAME (IF U.S. CITY GIVE 2-LETTER STATE ABREV.)     "
520 INPUT"";MP$
530 IF LEFT$(MP$,1)=" " THEN 250
540 FOR I=1 TO N
550 IF I=K THEN 570
560 IF M$(I)=MP$ THEN 600
570 NEXT I
580 PRINT" COULD NOT FIND  ";MP$
590 GOTO 500
600 V2=LA(I):H2=LO(I):GOSUB 1000
610 PRINT" BEARING TO ";MP$;" ";C$(I);" IS  ";A
620 GOTO 500
630 REM BEARINGS TO A GIVEN COUNTRY
640 PRINT"ENTER COUNTRY    ";
650 INPUT"";CT$
660 IF LEFT$(CT$,1)=" " THEN 250
670 PRINT"                 BEARINGS TO  ";CT$;""
680 CT=0
690 FOR 1=1 TO N
700 IF CT$<>C$(I) THEN 750
710 CT=1
720 V2=LA(I):H2=LO(I)
730 GOSUB 1000
740 PRINT P$(I);" ";M$(I);"  ";C$(I);TAB(30);A
750 NEXT I
760 IF CT=1 THEN 630
770 PRINT"UNABLE TO LOCATE COUNTRY  ";CT$
780 GOTO 630
790 END
1000 REM BEARING ROUTINE
1010 CK=0
1020 CB=(90-V1)*π/180
1030 AD=(90-V2)*π/180
1040 B=(H2-H1)*π/180
1050 IF B<0 THEN CK=1:B=-B
1060 IF B>π THEN CK=0:B=2*π-B
1070 IF B=π OR B=0 THEN 1240
1080 A=π/2
1090 X=ATN(SIN((A-B)/2)/(SIN((A+B)/2)*TAN(CD/2)))
1100 Y=ATN(COS((A-B)/2)/(COS((A+B)/2)*TAN(CD/2)))
1110 AT=ABS(X+Y)
1120 O=1
1130 IF AT<AD AND CK=1 THEN Q=2
1140 IF AT<AD AND CK=0 THEN Q=3
1150 IF AT>AD AND CK=0 THEN Q=4
1160 X=ATN(SIN((AD-CD)/2)/(SIN((AD+CD)/2)*TAN(B/2)))
1170 Y=ATN(COS((AD-CD)/2)/(COS((AD+CD)/2)*TAN(B/2)))
1180 A=INT(180*(X+Y)/π+.5)
1190 IF CK=0 THEN A=360-A
1200 IF A<0 THEN A=360+A
1210 IF Q>1 AND A<90 THEN A=A+180
1220 IF Q<4 AND A>270 THEN A=A-180
1230 RETURN
1240 IF B=0 THEN 1290
1250 BD=AD+CD
1260 IF BD>π THEN A=180:RETURN
1270 A=0
1280 RETURN
1290 BD=CD-AD
1300 IF BD>0 THEN A=0:RETURN
1310 A=180
1320 RETURN
2000 REM MENU ROUTINE
2010 PRINT"".
2020 PRINT"                  CHOOSE AN OPTION"
2030 PRINT"      0.  FIND BEARINGS TO GIVEN CALL PREFIX"
2040 PRINT"    1.  FIND BEARING TO GIVEN CITY"
2050 PRINT"    2.  FIND BEARINGS TO GIVEN COUNTRY"
2140 PRINT"    3.  PRINT BEARINGS TO MAJOR U. S. CITIES"
2150 PRINT"    4.  PRINT BEARINGS TO MAJOR CANADIAN CITIES"
2170 PRINT"    5.  PRINT BEARINGS TO MAJOR FOREIGN CITIES"
2180 PRINT"    6.  PRINT BEARINGS TO ALL MAJOR CITIES"
2490 PRINT"     ",
2500 INPUT"";W$
2510 IF LEFT$(W$,1)<>" " THEN W=VAL(LEFT$(W$,1))
2520 RETURN
3000 REM PRINT ROUTINES CALLED FROM HERE
3010 PRINT" SET PRINTER TO TOP OF PAGE. HIT RETURN WHEN READY"
3020 GET Z$:IF Z$="" THEN 3020
3030 OPEN 4,4
3040 L=0:X%=1:GOSUB 4000
3050 FOR I=1 TO N
3060 IF I=K THEN 3160
3070 IF L=63 THEN GOSUB 4000
3080 IF W=6 THEN 3120
3090 IF W=5 AND (C$(I)="USA" OR C$(I)="CANADA") THEN 3160
3100 IF W=3 AND C$(I)<>"USA" THEN 3160
3110 IF W=4 AND C$(I)<>"CANADA" THEN 3160
3120 V2=LA(I):H2=LO(1):GOSUB 1000
3130 PRINT#4,P$(I);SPC(11-LEN(P$(I)));M$(I);SPC(29-LEN(M$(I)));C$(I);
3140 PRINT#4,SPC(18-LEN(C$(I)));A
3150 L=L+1
3160 NEXT I
3170 PRINT#4:CLOSE 4
3180 RETURN
4000 REM PAGE HEADING SUBROUTINE
4010 IF L<>63 THEN 4030
4020 PRINT#4:PRINT#4:PRINT#4
4030 PRINT#4,CHR$(1);SPC(11);"BEAM HEADINGS FROM";CHR$(129);SPC(13);"PAGE";X%
4040 PRINT#4,CHR$(1);CHR$(1);SPC((26-LEN(CY$))/2);CY$
4050 IF W=6 THEN L=6:GOTO 4100
4060 IF W=5 THEN PRINT#4,CHR$(1);SPC(11);"TO FOREIGN CITIES"
4070 IF W=4 THEN PRINT#4,CHR$(1);SPC(11);"TO CANADIAN CITIES"
4080 IF W=3 THEN PRINT#4,CHR$(1);SPC(12);"TO U. S. CITIES"
4090 L=7
4100 PRINT#4:PRINT#4
4110 PRINT#4,"PREFIX";SPC(10);"CITY";SPC(20);"COUNTRY";SPC(8);"BEAM HEADING"
4120 PRINT#4
4130 X%=X%+1
4140 RETURN
5000 DATA 5,ABILENE TX,USA,32.5,99.8,8,AKRON OH,USA,41,81.5
5002 DATA 2,ALBANY NY,USA,42.5,73.75,5,ALBUQUERQUE NM,USA,35,106.5
5004 DATA DM,BERLIN,EAST GERMANY,52.5,-13.4,G,BIRMINGHAM,ENGLAND,52.4,1.9
5006 DATA HK,BOGOTA,COLUMBIA,4.5,74.25,VU2,BOMBAY,INDIA,19,-72.8
5008 DATA F,BORDEAUX,FRANCE,44.8,.5,DL,BREMEN,WEST GERMANY,53.1,-8.85
5010 DATA VK4,BRISBANE,AUSTRALIA,-27.5,-153.1,G,BRISTOL,ENGLAND,51.5,2.55
7000 REM ROUTINE TO LOOK UP YOUR CITY LOCATION
7020 FOR K=1 TO N
7030 IF CY$=M$(K) THEN 7100
7040 NEXT K
7050 F=0:K=0:RETURN
7100 F=1:V1=LA(K):H1=LO(K)
7110 RETURN
8000 REM A SORT BY CALL PREFIX
8010 PRINT"                    SORTING, PLEASE WAIT"
8020 FOR I=1 TO N:S(I)=ASC(LEFT$(P$(I),1))*10000:IF LEN(P$(I))<2 THEN 8050
8030 S(I)=S(I)+ASC(MID$(P$(I),2,1))*100:IF LEN(P$(I))<3 THEN 8050
8040 S(I)=S(I)+ASC(MID$(P$(I),3,1))
8050 NEXT I
8060 REM SELECTION SORT IN S
8070 M=N
8080 K=1:PRINT" ",
8090 FOR I=2 TO M:IF S(I)>=S(K) THEN K=I
8100 NEXT I
8110 IF K=M THEN 8150
8120 S(0)=S(M):P$(0)=P$(M):M$(0)=M$(M):C$(0)=C$(M):LA(0)=LA(M):LO(0)=LO(M)
8130 S(M)=S(K):P$(N)=P$(K):M$(M)=M$(K):C$(M)=C$(K):LA(M)=LA(K):LO(M)=LO(K)
8140 S(K)=S(0):P$(K)=P$(0):M$(K)=M$(0):C$(K)=C$(0):LA(K)=LA(0):LO(K)=LO(0)
8150 M=M-1:IF M>1 THEN 8080
8160 ET$=TI$
8170 RETURN
```

of the output list is included here which shows this enhanced printer.) The second thing is the trick I play with the input for the options. Before each input statement, there is a print statement which prints what appears to be blanks. They are actually shifted blanks. The input statement then backspaces over the shifted blanks. This means that if you just hit the return key in response to any question, the program will not get a null entry and blow up. Instead, it will get the shifted blanks. It then checks for shifted blanks and recovers to another part of the program.

If you are in one of the options, say the lookup-by-call-prefix option and give a null entry (just hit return), the program will branch back to the menu. If you just hit return in the menu, the program will branch back to requesting your city name. This allows you to change your location without having to exit the program and start over in reading and sorting all the data again. If you just hit return when you are asked for your city, you will exit the program.

I find that this program can help me get contacts I might otherwise miss from not having my antenna pointed in the right direction. It does everything except point the beam for me. Now, let's see, if I can wire the computer into the rotator control box ■

```
BEARINGS TO  AUSTRALIA

VK5 ADELAIDE  AUSTRALIA       256
VK4 BRISBANE  AUSTRALIA       261
VK8 DARWIN  AUSTRALIA         295
VK3 MELBOURNE  AUSTRALIA      258
VK6 PERTH  AUSTRALIA          270
VK2 SYDNEY  AUSTRALIA         253

ENTER COUNTRY ?
```

Fig. 2. This is what is printed on the video screen if you request option 2 and ask for Australia for the country. Note that in each case the call prefix, city, country, and beam heading are printed.

BEAM HEADINGS FROM
ATLANTA GA
TO FOREIGN CITIES

PREFIX	CITY	COUNTRY	BEAM HEADING
5A	TRIPOLI	LIBYA	58
5R8	TANANARIVE	MADAGASCAR	83
5Z4	NAIROBI	KENYA	73
6W8	DAKAR	SENEGAL	90
6Y5	KINGSTON	JAMAICA	154
7X	ALGIERS	ALGERIA	59
8R	GEORGETOWN	GUYANA	132
9M2	SINGAPORE	MALAYSIA	346
9Q5	KINSHASA	ZAIRE	88
BY	PEKING	CHINA	344
BY	SHANGHAI	CHINA	336
BY	CHUNGKING	CHINA	264
BY	CANTON	CHINA	341
BY	NANKING	CHINA	339
CE	SANTIAGO	CHILE	168
CE	IQUIQUE	CHILE	164
CM	HAVANA	CUBA	170
CP	LA PAZ	BOLIVIA	160
CT1	LISBON	PORTUGAL	61
CX	MONTEVIDEO	URUGUAY	156
DL	HAMBURG	WEST GERMANY	40
DL	BREMEN	WEST GERMANY	41
DL	MUNICH	WEST GERMANY	45
DL	FRANKFURT	WEST GERMANY	44
DM	BERLIN	EAST GERMANY	40
DU	MANILA	PHILIPPINES	329
EA	MADRID	SPAIN	58
EA	BARCELONA	SPAIN	55
EI	DUBLIN	IRELAND	44
EP	TEHERAN	IRAN	35
F	BORDEAUX	FRANCE	52
F	LYONS	FRANCE	50
F	MARSEILLES	FRANCE	52
F	PARIS	FRANCE	47
FY7	CAYENNE	FRENCH GUIANA	127
G	PLYMOUTH	ENGLAND	47
G	NEWCASTLE-ON-TYNE	ENGLAND	42
G	LIVERPOOL	ENGLAND	44
G	LEEDS	ENGLAND	43
G	LONDON	ENGLAND	45
G	BIRMINGHAM	ENGLAND	45
G	MANCHESTER	ENGLAND	43
G	BRISTOL	ENGLAND	46
GI	BELFAST	NORTHERN IRELAND	43
GM	EDINBURGH	SCOTLAND	41
GM	ABERDEEN	SCOTLAND	39
GM	GLASGOW	SCOTLAND	41
HA	BUDAPEST	HUNGARY	43
HB	ZURICH	SWITZERLAND	47
HC	GUAYAQUIL	ECUADOR	172
HK	BOGOTA	COLUMBIA	160
HP	PANAMA CITY	PANAMA	168
HS	BHAKOK	THAILAND	353
HZ	MECCA	SAUDI ARABIA	52
I	NAPLES	ITALY	51
I	ROME	ITALY	51

Fig. 3. Sample of beam-heading list.

CUSHCRAFT

A3 3 Element Triband Beam $172.50
A4 4 Element Triband Beam $224.50
A743 7 & 10 MHz Add On for A3 $61.20
A744 7 & 10 MHz Add On for A4 $61.20
AV3 3 Band Vertical 10-20m $44.20
AV4 4 Band Vertical 10-40m $81.50
AV5 5 Band Vertical 10-80m $88.50
R3 14,21 28 MHz Ringo $224.50
32-19 Boomer 19 Element 2m $81.50
214B Jr Boomer 14 Element 2m $88.00
A147-11 2m 11 Element Antenna $37.50
A147-4 2M 4 Element Antenna $23.75
ARX-2B 134-164 MHz Ringo Ranger II $34.00
A144-10T 145 MHz 10 Element $44.20
A432-20T 432 MHz 20 Element $44.20
A14T-MB Twist Mounting Boom & Bracket $23.75

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45G 10 ft. Stacking Section $87.50
25AG 2,3 or 4 Top Section $52.50
HDBX 48 48 ft. Free Standing Tower $320.00
HBX56 56 ft. Free Standing Tower $340.00
FK2548 48 ft. 25G Foldover Tower $725.00*
TB3 Thrust Bearing $48.00
SB25G Short Base for 25G $16.50
BPH25G Hinged Base Plate $59.75
AS25G Accessory Shelf $9.50
HB25AG 14" House Bracket $14.50
BPC25G Cement Base Plate $32.00
BAS25G Short top section w/acc. shelf $36.00
M200 16 gauge, 10 ft, 2" O.D. Mast $19.50
M200H 1/8" wall 10 ft 2" O.D. Mast $36.00

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Improves 10-20m $67.00
C-4 Mini-Vertical 6/10/15/20m $59.00

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HUSTLER

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5BTV 80-10 Mtr. Vertical $100.00
M01/M02 HF Mobile Mast $18.00

HF Mobile Resonators	Std. 400W	SUPER 2KW
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20m	$11.00	$16.00
40m	$13.00	$18.00
75 or 80m	$14.00	$29.00

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SSM-2 Commercial S.S. Ball $14.00
SF-2 5/8 Wave, 2 Meter Antenna $9.00
HOT Hustloff Mt. with Swivel ball $14.00
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TH7DX Thunderbird, 7 Element $376.00
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105BAS 5 Element 10m "Long John" $114.00
155BAS 5 Element 15m "Long John" $175.00
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4 Conductor. 7.5¢/ft

John M. Franke WA4WDL
1310 Bolling Avenue
Norfolk VA 23508

Try the GHz Getter

—a marvelous microwave antenna you can build

I have always been interested in antenna design, and the amateur microwave bands permit experimentation with scaled-down antennas. The short wavelengths permit the testing of designs without a hundred-acre antenna farm. However, a lack of activity limits the testing and application of the antennas. Recently, MDS television service was added to this area, providing a reliable, constant-power microwave signal for antenna testing.

The transmitting antenna is located several miles away—hence it approximates a far field source. (My microwave-antenna range is a second-story window.) The frequency, 2.15 GHz, is high enough to keep the antenna size down to a practical level yet not so high as to make construction tolerances beyond amateur capabilities. Gain comparisons are made by placing an attenuator between the microwave converter and the television receiver and noting how much attenuation must be added or removed to maintain a constant signal level.

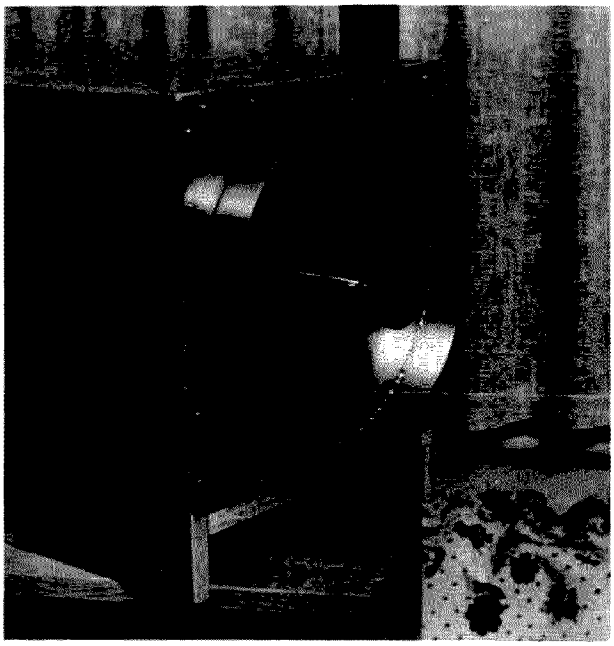

Photo A. Antenna on a test mount.

The first antenna I tried was the popular coffee-can horn. Since then, it has become my standard to which all other antennas are compared. Other horn and helix antennas have been constructed and tested, but have one major drawback: their long length. I decided to try a more compact planor antenna. Collinears and other phased arrays were ruled out because of problems with the phasing lines. Digging through my file on antennas, I ran across the short backfire and constructed the antenna shown in Fig. 1. Several feeds were built and tested. The first used a microstrip disk and offered no better gain than the coffee can. The final feed is the one used on the original design.[1,2] It consists of a slot-fed dipole with a small disk-shaped reflector. The dimensions shown are in terms of wavelength, making frequency-scaling to 1296, 2304, or other frequencies easy.

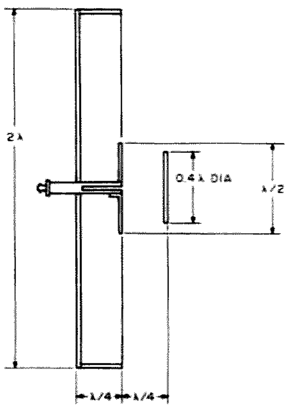

Fig. 1. Short backfire antenna.

The ground plane is made from a 300-mm (1-foot) -square piece of single-sided PC board. Other materials, including screen wire, could have been used. Another piece of single-sided board 35 mm by 864 mm (1⅜" by 34") was formed into a circle and the ends butted together. A small piece of board is epoxied so that it overlaps the joint. After curing, the ring was edge-soldered to the ground plane, forming

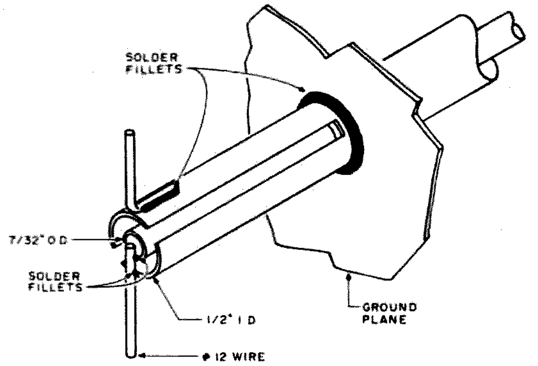

Fig. 2. Dipole-feed details.

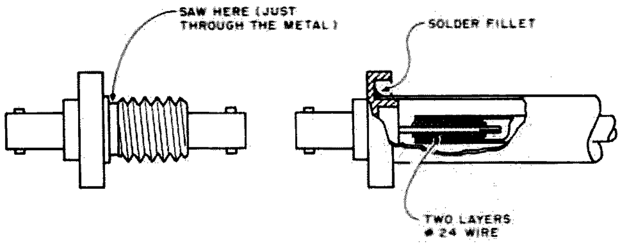

Fig. 3. Connector details.

an open cavity two wavelengths in diameter and one-quarter wavelength deep. I drilled a hole pattern in the cavity center to allow experimentation with different feeds or rotating the feed polarization. The radiation pattern is symmetric with a half-angle response of 30 degrees to the −10-dB level.

The dipole feed is formed from two concentric pieces of thin-wall brass tubing that comes in telescoping sizes at a local hobby shop. The outer conductor has an internal diameter of one-half inch. The inner conductor has an outer diameter of seven thirty-seconds inch. The construction details of the dipole and the connector are shown in Figs. 2 and 3, respectively. Note that one dipole element shorts the inner and outer conductors together. The other stops at the outer conductor.

The dipole feed is assembled by first sawing through the outer sleeve of a BNC bulkhead feedthrough and discarding the threaded portion. The exposed inner conductor is built up with two layers of number 24 bare wire. The brass inner conductor tubing is slotted for about 10 mm, slid over the built-up inner conductor, and the assembly is sweat-soldered together. The inner conductor is intentionally left too long and will be trimmed later.

Next, the outer conductor is cut to length (not critical) and slotted. The two slots are each one-quarter wave long. Slotting is best done by first inserting a one-half-inch diameter dowel rod in the outer conductor to prevent buckling. The slot width is a nominal one-sixteenth inch. The outer conductor is then slid back over the inner conductor assembly and the inner conductor length is marked. After trimming the inner conductor and removing any burrs, the assembly is joined together with a solder bead around the coax fitting. A hole slightly larger than the outer conductor is drilled in the center of the ground plane or support plate if you intend to make interchangeable feeds. The outer conductor is soldered in place with the slot roots flush with the front surface.

The dipole elements are added last. They are made from number 12 bare wire. The element that shorts the inner and outer conductors doubles as a support for the inner conductor. The subreflector disk is epoxied on two half-wavelength-long wooden posts. I used wood instead of polystyrene because it was convenient.

Although adjustments aren't normally required, it should be easy to replace the dipole wires with telescopic tubing to permit fine tuning. My tests show that the short backfire has a gain of 8 to 9 dB over the horn, a level between large, high-gain antennas and simple dipoles. ■

References

1. H. W. Ehrenspeck, "The Short Backfire Antennas," *Proceedings of the IRE*, No. 53, pp. 1138–1140 (August, 1965).
2. Dr. Akhileshwar Kumar, "Backfire Antennas Aim At Direct Broadcast TV," *MicroWaves*, April, 1978 (contains 83 references).

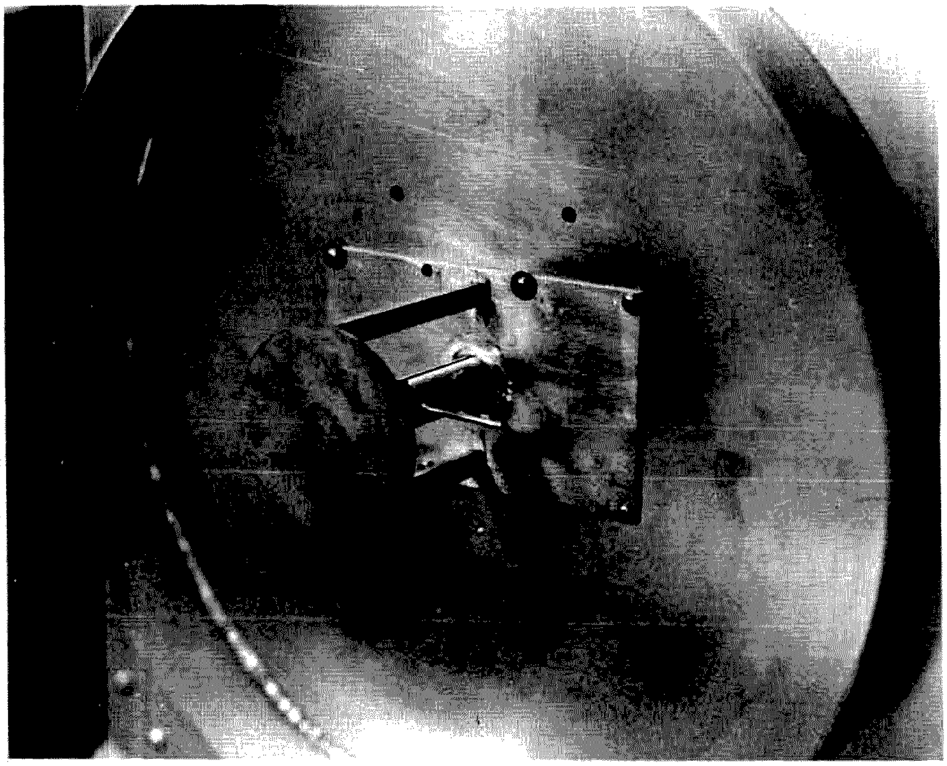

Photo B. Close-up of feed.

Stan Gibilisco W1GV/4
PO Box 561652
Miami FL 33156

The Multiband Vertical

—an aesthetically pleasing antenna with a punch

Space limitations often dictate the use of a vertical antenna on city lots. After a recent move, I found myself faced with this kind of situation. But not only was there insufficient space for any kind of horizontal antenna, there wasn't even room enough for a ground-radial system for my proposed vertical! Putting the thing on the roof was just out of the question. The landlord wouldn't allow any defacing of the physical plant.

In order to get on the air with any sort of efficient radiator, I would have to build it to meet the following set of requirements:

- It had to be put on the smallest possible amount of real estate, preferably only a few square feet.
- It could not have any ground-radial system (a condition essentially dictated by the above requirement).
- It had to be relatively unobtrusive—no complicated set of spears or prongs or guy wires—lest somebody complain and start imagining all sorts of horrible RFI.
- It had to be efficient, since my intent was to run QRP.
- It had to cover 20, 15, and 10 meters.

This may sound like a mutually exclusive set of parameters, but it's not!

The Vertical Dipole

The antenna described here is a multiband vertical dipole. It was developed as a modification of the familiar ground-plane antenna shown in (a), Fig. 1. A ground-plane antenna, elevated so the feedpoint is at least a quarter wavelength above the ground, requires only a few resonant (quarter-wave) radials in order to have excellent efficiency and low-angle radiation. But suppose that, instead of the radial wires shown at (a), a single length of tubing is used, as shown at (b)? A 20-meter antenna of this va-

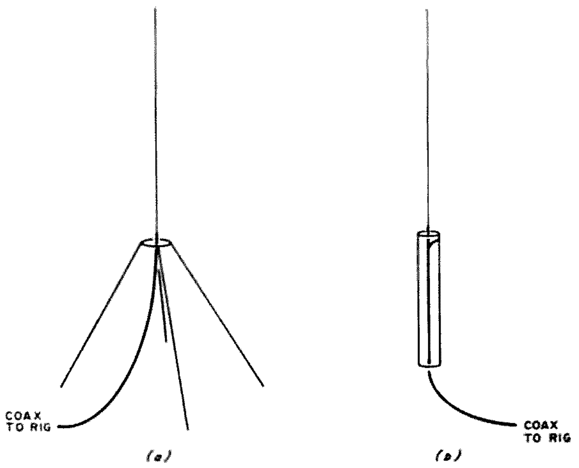

Fig. 1. (a) The conventional ground-plane antenna, with a quarter-wave vertical radiator and three quarter-wave radials. (b) A modification of the ground plane where the radials are replaced by a single quarter-wavelength section of tubing through which the feedline is run. The center conductor of the coaxial feedline should be connected to the top section in both cases.

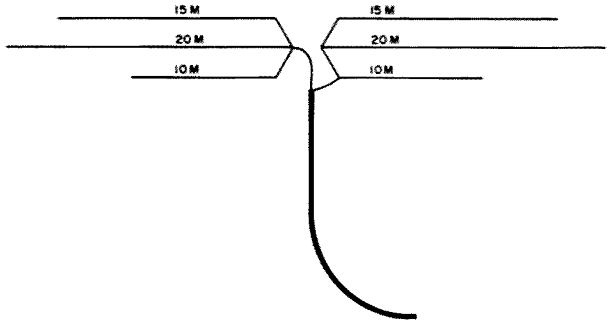

Fig. 2. Connecting three dipole antennas in parallel to get three-band operation. On a band where one of the dipoles is half-wave resonant, the other two are nonresonant and thus do not contribute to the system in any way.

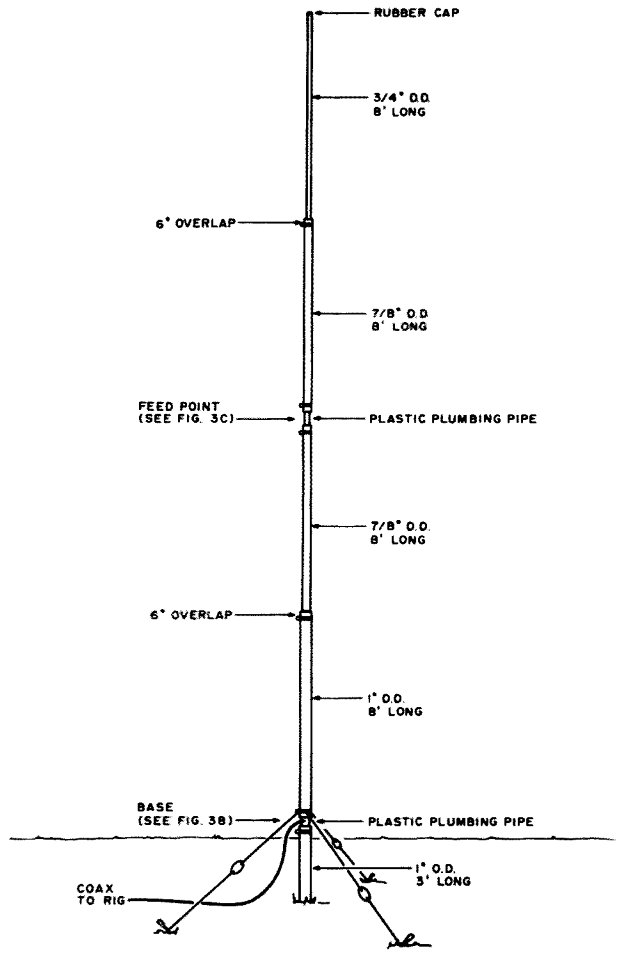

Fig. 3 (a). The overall construction of the 20-meter main support is shown. The tubing is slit and clamped together with hose clamps. Overall height, assuming the base is 2 feet above ground level, is just over 33 feet.

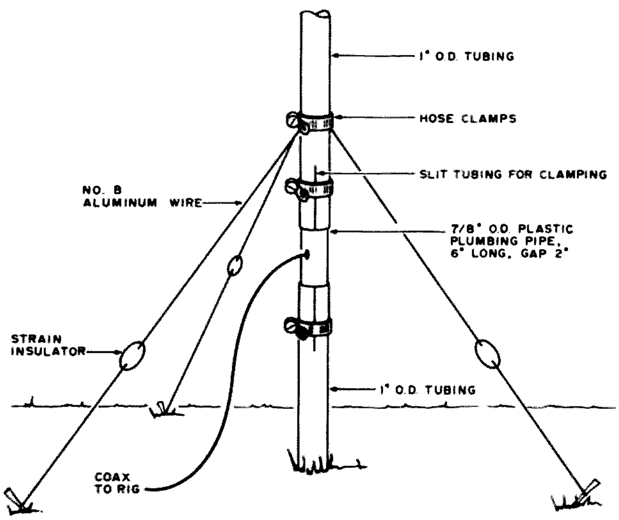

Fig. 3 (b). The base mount, showing the 20-meter pruning wires which act as reinforcement for the plastic pipe.

riety was constructed and tested at W1GV/4 and was found to perform exceptionally well.

How does an antenna such as that shown in (b), Fig. 1, work? Actually, it can be thought of as simply a ground-plane antenna in which the set of radials is brought straight down from the feedpoint. It may also be thought of as a vertical dipole in which the feedline is brought in from the underside, directly through the lower radiating section. However you want to visualize this antenna, though, it works—well!

Multiband Operation

One of my requirements for this antenna was that it have multiband capability. Because of the feed method, adding traps did not appear feasible. (It would not be a good idea to run the coax through the trap inductors.) One technique, commonly used with home-brew multiband dipole arrangements, came to mind: Simply place the dipoles for each band in parallel. Fig. 2 illustrates this scheme.

This kind of antenna will work very well on 20, 15, and 10 meters; on each band, the antenna cut to the proper length would accept and radiate electromagnetic energy, while the other two antennas would not, since they would be poorly matched. The result would be good low-angle radiation and true ½-wavelength resonance on all three bands.

The only possible problem seemed to be how to physically construct the "multiple vertical dipole" antenna. This proved easy, requiring only a modification of the existing 20-meter vertical dipole.

Construction of the Main Support

Fig. 3(a) shows the construction of the 20-meter antenna which forms the main support for the structure. Aluminum tubing is used for the radiating elements, with 1-inch o.d. at the bottom tapering to ¾-inch o.d. at the top. The 8-foot sections overlap 6 inches, so each side of the dipole is 15 feet 6 inches high. To obtain exact resonance, three short lengths of No. 8 soft aluminum ground wire are attached to the base, as shown. They should be trimmed so the swr is minimum at the desired frequency. A good starting length for the wires is 18 inches. Strain insulators should be used so the wires can provide extra support for the antenna base; otherwise, high winds might cause the antenna to blow down. (It's over 30 feet high!)

Fig. 3(b) is a close-up drawing of the base mount. A short piece of ⅞-inch o.d. plastic pipe is used to insulate the antenna base from the ground. The feedline, consisting of RG-58/U coaxial cable, is fed through a 5/16-inch hole in the side of the pipe, upward inside the lower part of the antenna, to the feedpoint.

Fig. 3(c) shows the construction of the center feedpoint. A short section of ¾-inch o.d. plastic pipe is

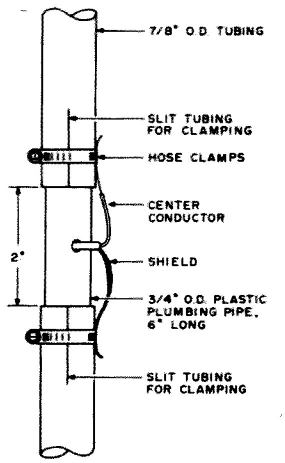

Fig. 3 (c). The feedpoint. To reduce the chances of corrosion, the entire feedpoint connection should be wrapped with electrical tape before the hose clamps are installed.

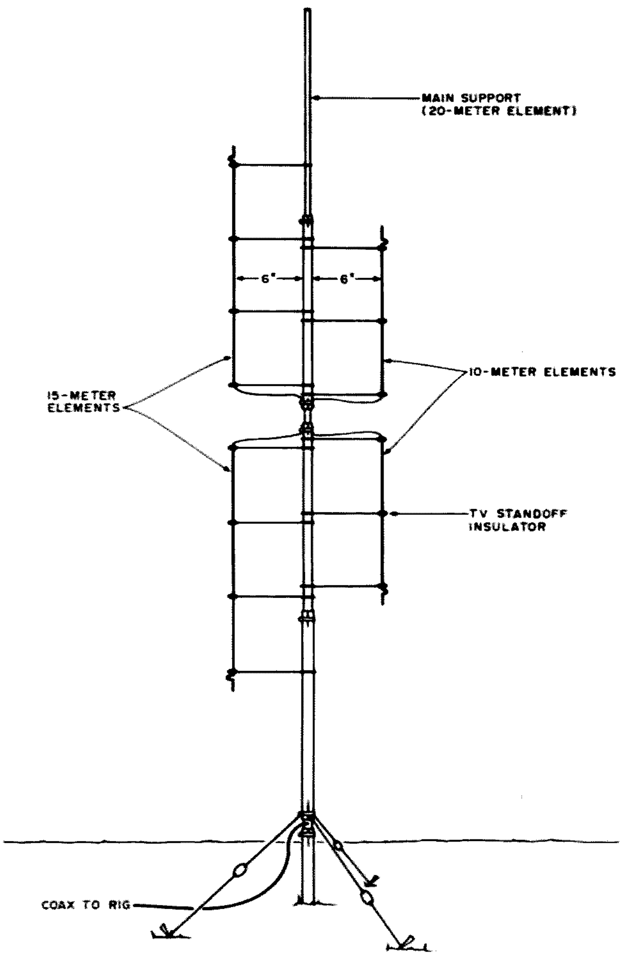

Fig. 4 (a). Overall picture of the completed vertical dipole. The 10- and 15-meter elements are spaced 6 inches from the main support.

used. Drill a 5/16-inch hole in the side of the pipe at the center, as shown, and bring the coax out. The shield is connected to the lower part of the antenna, and the center conductor to the top, via those convenient hose clamps. It's a good idea to tin the exposed leads with solder and wrap the entire connection with electrical tape before clamping. Those hose clamps serve to hold the antenna together mechanically as well as electrically, so be sure to put them on tight. You might even want to put a separate pair of clamps on the tubing independent of the electrical connections to ensure rigidity of the structure.

Since this antenna is quite large, it is important that the base mount be properly assembled. The tubing at the bottom should be driven at least 12 inches into the ground. The set of resonator/guy wires should be tight, have a slant of at least 45 degrees to the vertical (less than 45 degrees to the horizontal), and their anchors should be *very* secure. Also, don't forget the little rubber cap at the top of the thing! Little details like this could be responsible for an early demise if neglected.

Adding 15 and 10 Meters

Fig. 4(a) shows the complete antenna, illustrating the installation of the 15- and 10-meter elements. The 15-meter elements should be precut to 11 feet 2 inches; the 10-meter elements should be precut to 8 feet 6 inches (some shortening will be needed to resonate them). The 15- and 10-meter elements are made of No. 8 soft aluminum ground wire and are spaced from the 20-meter main support on opposite sides, as shown, using 6-inch clamp-on TV standoff insulators. Care must be taken to see that the wires do not come into contact with the 20-meter element, except of course at the feedpoint. Electrical contact at any other point will disturb the resonance on 15 or 10 meters. The wires must be pulled tight, and they must not touch the metal rings on the standoff insulators.

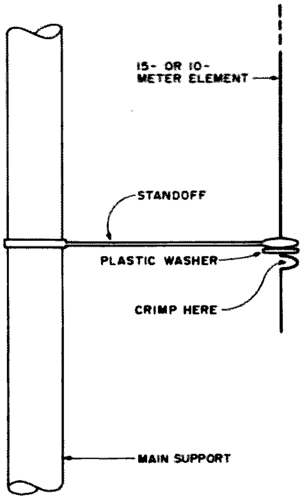

Fig. 4 (b). Method of securing the ends of the wire elements. A few inches should be left free for pruning.

The element ends are secured as shown in Fig. 4(b). Crimp the wire slightly, as shown, after sliding a plastic washer of at least 1½ inches diameter around it to prevent short-circuiting to the standoff ring. Leave about 10 or 12 inches of wire past the standoff for pruning purposes.

When trimming the elements, it will be necessary to raise and lower the antenna, since both the bottom and top elements must be cut to the same length. The final length will depend, to some extent, on how close the antenna is to trees and other obstructions. (The antenna should be located so that it cannot fall on utility lines!)

Theoretical element lengths (for each side of the dipole) are given in Table 1 as a function of frequency on 10 and 15 meters. At W1GV/4, the elements were trimmed for 21.100 and 28.500 MHz, and the lengths turned out to be about an inch shorter than the theoretical values on both bands. This was probably because of the abundant foliage on the property.

If you find that the resonant lengths appear nowhere near the values given in Table 1, first check to be sure that there are no short circuits to the main element. If there are none, you might have antenna currents on the feedline.

Decoupling the Line

Since this is an unbalanced antenna, meaning it is not symmetrical with respect to the feedline, it is possible that there may be rf currents on the shield of the coax. This is especially likely if the feedline happens to be a multiple of an electrical half wavelength on the operating frequency.

To decouple the line, the first thing to do is make certain that the length of the line is as far away from resonance as possible on all three bands simultaneously. Fig. 5 shows some of the best lengths, as well as those lengths that should be avoided. (Note that a feedline length of 66 feet is especially bad since it is resonant on all three bands!)

If this technique does not solve the problem, then you will have to install a choke in the line. To do this, simply wind the coax about 20 times around a piece of 2-inch o.d. plastic pipe, securing the coil in place with electrical tape. The choke should be placed at the

point where the feedline enters the base of the antenna. After the choke has been wound, the remaining length of line to the rig should be nonresonant, as shown by Fig. 5.

A choke coil should be required only if high power is used, since the probability of getting rf in the shack increases with the power output of the transmitter.

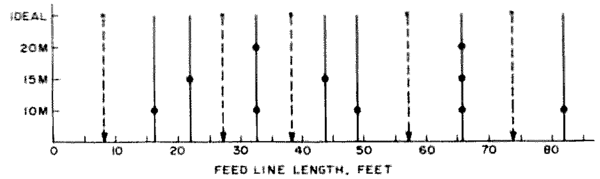

Fig. 5. Feedline resonant lengths are shown by dots and solid lines; these lengths should be avoided. Ideal lengths for a 20-, 15-, and 10-meter feedline are shown by an X with a dotted line. Resonant frequencies chosen for this chart are 14.175, 21.225, and 28.500 MHz, representing an approximate median for each band.

Frequency (MHz)	Element Length
21.000	11'2"
21.100	11'1"
21.200	11'0"
21.300	11'0"
21.400	10'11"
28.000	8'4"
28.250	8'3"
28.500	8'2"
28.750	8'2"
29.000	8'1"
29.250	8'0"
29.500	7'11"

Table 1. Theoretical resonant lengths for each side of a dipole antenna as a function of frequency. These lengths are approximate because of possible capacitive loading effects from nearby objects. Lengths are to the nearest inch. These values are measured from the feedpoint connection along the wire to the end of the element.

Performance

Using only 10 Watts output, many contacts have been made on all three bands. The low-angle radiation of this antenna appears to be exceptional, which is to be expected of a vertical dipole. The current loop is elevated about 17 feet above ground; this helps reduce absorption by nearby obstructions.

Particularly on 10 meters, where very little power is needed to produce DX, several European countries have been worked, often when competing against stations using yagis or quads and much more power.

The swr at resonance is better than 2 on all bands. It gets up to about 4 at the top end of 10 meters, since I adjusted it for 28.500 MHz. No matching network has been necessary to obtain proper transmitter tuning in normal operation.

Adding More Bands

It should not be difficult to add elements for the new bands at 18 and 24 MHz once they are opened for amateur use. These elements could simply be placed in parallel with the other three antennas.

There appears to be some possibility that, by adding enough elements of progressive lengths in parallel, it might be possible to build a broadband antenna capable of continuous coverage between two set frequencies. There are some structural problems involved with this, but I am presently working on the idea. If the results are good, I will present them in a future article. ■

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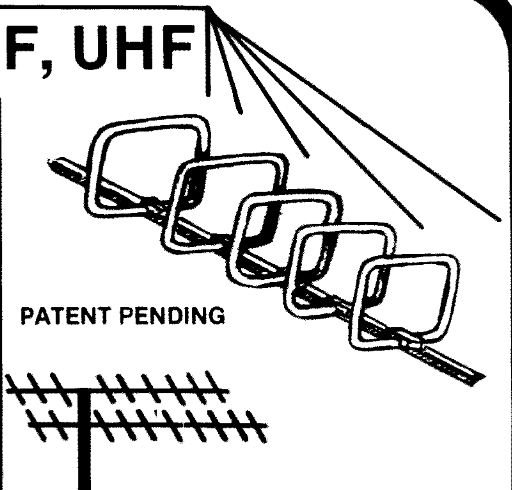

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The Campbell J

—a little antenna that "can"

Carlton Moseley W4YVY
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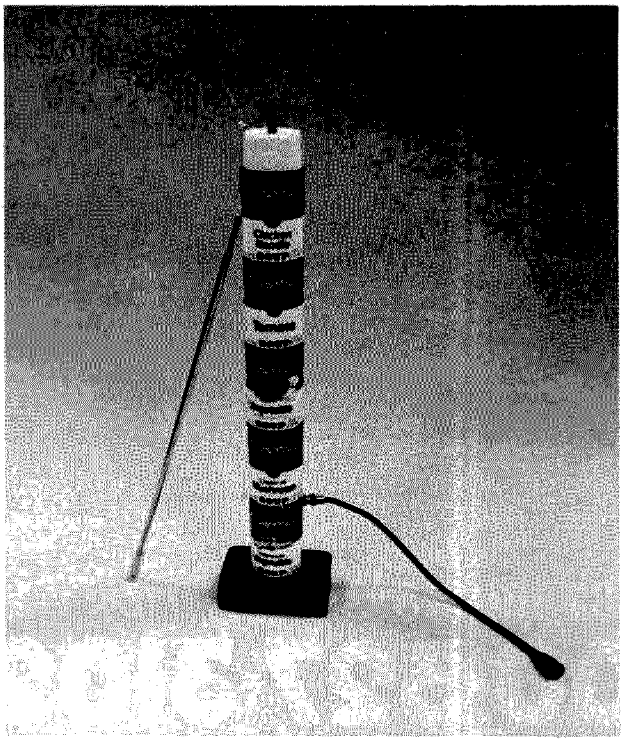
The Campbell Soup can antenna is a variation of the familiar J antenna. Four advantages of the soup can antenna are: (1) its unique construction uses many parts from around the house, (2) it can come apart for portable operation and storage, (3) the matching section is unbalanced to match coaxial feedlines, and (4) the matching section has immunity to detuning by nearby objects. Like the J antenna, the soup can antenna gives 3 dB gain over a ¼-wavelength whip because it uses a ½-wavelength radiator.



Two-meter soup can antenna.

Background

In a J antenna the bottom ¼ wavelength is a parallel transmission line used for matching. This matching section is shorted together at the bottom to give a zero impedance. Then, due to the transformation of a ¼-wavelength transmission line, the top of this ¼-wavelength matching section has a very high impedance. This very high impedance matches the impedance of an endfed ½-wavelength antenna. By tapping up on the ¼-wavelength matching section, a point can be found for the proper impedance match for the feedline being used.

The Campbell Soup can antenna, like the J antenna, uses a ¼-wavelength matching section, but in the Campbell Soup can antenna, the matching section is a coaxial line. The bottom of the soup can coaxial matching section is shorted together to give a zero impedance. Then ¼ wavelength above the zero impedance is, once again, the very high impedance needed to match an endfed ½-wavelength antenna.

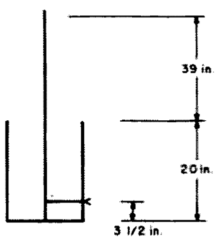


Fig. 1. Two-meter soup can antenna dimensions.

Because of the coaxial design, this matching section can be fed with coaxial line without upsetting a balanced condition. Also, being coaxial, if metal objects are near the matching section, they will not upset the matching section operation.

Construction

Both ends are cut out of 3 of the Campbell Soup cans. These will be used in the middle of the coaxial matching section. For the top can of the coaxial matching section, one end is completely removed and the other end is cut out except for a ¼-inch-wide lip.

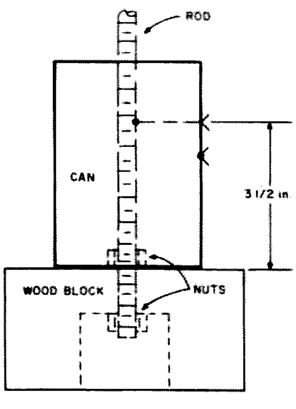


Fig. 2.

Later this lip will be the support for the plastic spray can top. For the bottom can, one end is completely removed and the other end has a hole cut in it to just pass the 5/16-inch threaded rod.

The wooden block should have a hole bored through it that is just big enough to pass the 5/16-inch threaded rod. The bottom of the block should have a larger hole countersunk in it to hold a nut and washer.

The bottom soup can is mounted on the wooden block using the threaded rod. The soup can is turned so that the end with the small hole is next to the wooden block. A nut and washer in the soup can and another nut and washer in the countersunk hole of the block will hold the items together. The rod should not extend below the block so that the block can sit on a surface and not scratch it.

A coax chassis connector is mounted on the side of the bottom soup can about 3½ inches from the bottom. The center conductor of the coax connector is attached to the threaded rod 3½ inches from the bottom of the soup can. It can be soldered, but a convenient method is to wrap a wire around the rod and hold it in place between two nuts and washers.

The remaining 4 soup cans are soldered together with the top soup can on one end with the lip away from the other cans. Next the 4 soup cans are soldered to the bottom soup can so that the lip of the top soup can is on top.

The top of the soup cans and the top of the threaded rod must be held rigid yet be insulated from each other. The plastic spray can top is used for this. A hole is cut in the spray can top so it will just slide over the threaded rod and then rest on the lip of the top soup can. The plastic spray can top can be held in place between two nuts and washers or, better yet, by one nut and washer screwed down tight. A piece of sheet plastic or thin wood will also work as an insulator and support.

Finally, the replacement automobile antenna is mounted on top of the threaded rod. Most replacement auto antennas designed for stud mounting have setscrews that will hold them in place.

MATERIALS REQUIRED

- 5 Campbell Soup cans (or any other can 4 inches tall and about 2-1/2 inches or less in diameter)
- 1 5/16-inch threaded rod, 24 inches long (available at most hardware stores)
- 6 nuts for the 5/16-inch threaded rod
- 6 washers (use with the 6 nuts if desired)
- 1 adjustable replacement automobile antenna that will fit over the 5/16-inch threaded rod (the rod or antenna size may be varied to get a combination that will fit together)
- 1 two by four wood block, 5 inches long (this block size may be varied to suit the builder's needs just as long as the block is large enough to support the soup cans)
- 1 coax chassis connector (BNC type or SO-239)
- 1 plastic spray can top approximately 2-7/16 inches in diameter that will just fit inside an empty soup can (see text)

Adjustments

The only adjustment is to adjust the length of the auto antenna. A length of 39 inches is needed as measured from the top of the top soup can to the top of the auto antenna. ■

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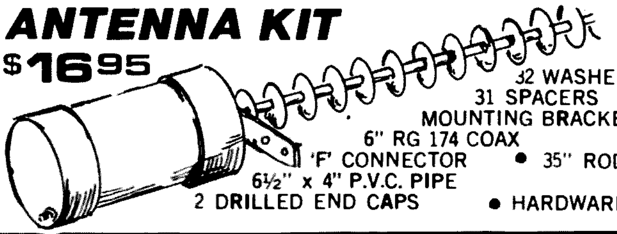

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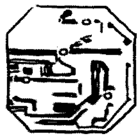

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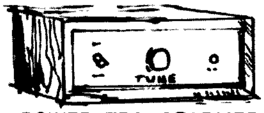

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Avoid an Electrical Nightmare

—sidestepping ground faults

A. R. Taylor W5OS had a very interesting article in the February, 1981, issue of *73* titled, "Stalking the Elusive Ground Fault." He went through anxiety trying to correct the situation. What was the situation? Simply, he had extra-high voltage on one side of his three-wire 240-volt system and very low voltage under load on the other side.

The high-voltage side burned out his fluorescent light (in flames, actually) and burned out the transformer in an electric clock-radio. The other side of the 120-ground-120-volt system had such a low voltage under load that his freezer and refrigerator would not run. However, with those two devices pulled off the circuit, his lights on that 120-volt side would work.

What happened is not common, but happens occasionally when aluminum wire is used between the power-line pole transformer and the house circuit. It happened to me after I moved into a newly-constructed home with a brand-new service connection. *It is potentially dangerous!*

The symptoms in my case were the sudden brightening of reading lights which when turned off and then on again would work satisfactorily. A similar symptom occurred in another room with sudden tremendous brilliance of the lights and increased intensity of the TV picture. A transformer in the house heating system burned up and was replaced under warranty. At the time, it was thought it was a defective transformer since it was a brand-new installation.

The problem was definitely intermittent and, of course, did not show on a recording voltmeter that the power company put on the house line for 24 hours; those tests never work when you want them to. At times, I could measure *220* volts on one side of a 120-volt circuit and practically zero on the other side, but it would become normal if any load were changed.

Let's stop a minute and see what is happening; it definitely is a ground fault, whatever that means at this point in the story.

Fig. 1(a) shows a 240-volt, three-wire system with a 100-Watt lamp on one side of a 120-volt line and a 1000-Watt toaster on the other side of the line. From Ohm's Law we find that the resistance of the lamp and toaster using 120 volts is: ($R = E^2/P$) $R_{lamp} = 120^2/100 = 144$ Ohms; $R_{toaster} = 120^2/1000 = 14.4$ Ohms.

A ground fault occurs when the ground connection at the supply transformer opens—see Fig. 1(b). We still have our 240 volts, but it is across the light and toaster which are now in series. How much current flows through that series load? $I = E/(R_L + R_T) = 240/(144 + 14.4) = 1.52$ Amperes.

More important, however, is the voltage across the lamp and the toaster, individually. $E_L = I_L \times R_L = 1.52 \times 144 = 218.9$ volts; $E_T = I_T \times R_T = 1.52 \times 14.4 = 21.9$ volts.

Now do you see why the lights get so bright and the toaster appears not to be working? Do you see why the fluorescent light burned up and the freezer would not work?

After I performed the above arithmetic, I knew why a filter capacitor in the high-voltage power supply of my TS-520 shorted and had to be replaced as well as all the other phenomena that occurred. Incidentally, I now have the TS-520 on its 240-volt connection across the 240-volt line instead of using 120 volts.

The situation came to a head one day when the fault continued regardless of switching loads on or off. A call to the utility company brought a quick response—a crew of three men. After all, if a burned-down house can be traced to a fault by the power company, it creates a problem for them. Actually they really do want to keep satisfied customers.

The fault continued long enough for them to test and assure themselves that it was not a house wiring problem; then the fault magically disappeared. They knew what to do, though. They climbed the utility pole upon which the 2700-to-240-volt transformer was mounted and inspected all the connections from it to the three-wire service line.

Sure enough, the ground connection was unsatisfac-

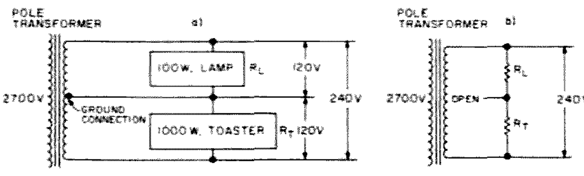

Fig. 1. (a) 120-volt load distribution. (b) Results of open ground connection on 120-volt circuits.

tory. They installed a new connector and assured me no additional problems would occur. Over two years have gone by and none has. Since the three-wire service to the house is aluminum wire which is prone to produce a high-resistance corrosion layer on its outer surface, you can be sure that I will have that connection checked at the slightest indication of a ground fault occurring again.

A number of you with new homes will say, "I have a ground-fault circuit tester on my house switch panel." That will be true but, unfortunately, we are talking about two different things.

House wiring for each 120-volt circuit consists of three wires. A black insulated wire is described as "hot" since it is energized at all times. The white insulated wire conducts no electric current unless the circuit is connected, i.e., a switch is "on." The white wire is called "neutral." The third wire is the grounding wire and connects all the metal parts in the wiring system to earth through the cold-water piping or a pipe driven into the ground. Items grounded include metal outlet and switch boxes, metal conduit, metal cases of stoves, refrigerators, and washers. A three-prong appliance cord continues the grounding all the way to the outer shell of a test instrument or hand power tool. Any fault in such an appliance, as a loose wire or worn insulation touching its grounded metal frame, will cause a house fuse or circuit breaker to trip. Appliances or tools that do not have this protection are dangerous—you could get a shock if something should go wrong with the internal wiring.

Many homes have a Test button on the service panel which when pressed will open the circuit being tested, indicating that no ground fault exists.

Perhaps it would be better to describe the outside service problem as "an open ground return," and not a ground fault, although it is. However, know the difference!

It is worth repeating: An open ground return in a three-wire, 240-volt system will put unusually high voltages on certain loads of the house system which may cause them to overheat, burst into flames, and destroy your home. Be aware of the symptoms and cure. The total destruction at my home before correcting the problem was as follows: 1) power transformer in heating system, 2) smoke detector connected to house line, 3) high-voltage capacitor in TS-520, 4) power supply in garage door opener, 5) vertical linearity in TV set.

Those low voltages may be just as dangerous where refrigerator or washing machine motors are concerned. Insufficient voltage will prevent them from running, thus preventing them from producing a back emf to raise their effective impedance. They will present a low dc resistance to the line voltage, perhaps drawing abnormal current, heating up, bursting into flames, and who knows what then.

It makes me a little apprehensive when I go on a vacation. Have I disconnected *all* appliances? But can I? No, because I like to have programmed lights go on in various rooms at night to indicate occupancy. Probably those lights would burn out fast at 218.9 volts before any damage could be done. But what about the 120-volt smoke detector? Yes, and how about that little door-bell transformer nailed to the cellar ceiling floor beam: That's never turned off! ■

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In an area where the repeater density is not too high, it's been my experience that any and all frequencies in between the active repeater channels are fair game and are used frequently for simplex operation. It invariably seems that when I'm asked to go to a simplex frequency from a repeater, I'm always 5 kHz off with the IC-280.

To correct this problem, I found that I could modify the digital coding on the MHz lines from the microprocessor, IC7, to the PLL. This fools the microprocessor into thinking it's tuning 144-145 MHz in 5-kHz steps when the PLL actually sees 146-147-MHz frequencies. This is a reversible change and does not add any external switches or accessories that would distract from the clean looks of the IC-280.

The MHz data line logic from the microprocessor to the PLL is shown simplified in Fig. 1. It can be seen that the difference between 144-145-MHz data is the logic on lines B3 and C3.

I decided originally to use the circuit shown simplified in Fig. 2 to modify the data lines. By hard-wiring the transmitter in the 10-Watt mode, the HI-LOW button on the front panel becomes available for controlling the gate operation. In the normal position, B3 and C3 data would not change through the gates. When a high is placed on the switch, the exclusive OR gating will reverse the data levels on the two lines going to the PLL.

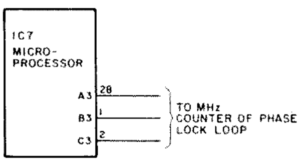
After spending several evenings experimenting, I found the parts required to interface a 4070 quad exclusive OR chip into the circuit were more than I wanted to use.

I finally decided that even with all the CMOS IC sophistication, a simple DPDT relay would do the same thing. I settled on a Potter and Brumfield type HPS microminiature DPDT relay. It measures only .41" × .81" × .41". Mine has a 24-volt coil but keys reliably with as little as 10 volts. Twelve-volt relays are available in this line. Using contact cement, I placed mine on the underside of the groundshield that covers IC3 on the PLL board. The relay pins extend out from under the cover by IC6. All connections are soldered directly to the relay pins. Fig. 3 shows the relay wiring. Solder the jumpers before cementing the relay can down.

Remove the gray wire from the main unit board printed circuit pad marked HI-LOW. Pull the wire back through the clear plastic spaghetti and reroute it for connection to the relay coil. This wire is from the HI-LOW switch. Ground the other side of the relay coil.

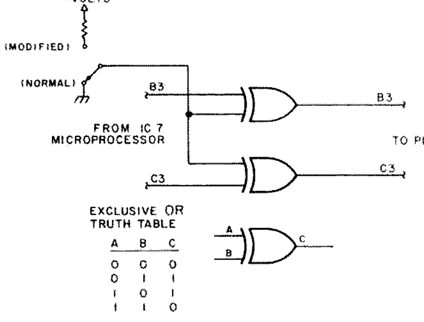
Jumper the HI-LOW solder pad to ground. This sets 10-Watt operation of the transmitter. With it left open, you would have constant 1-Watt operation.

Find connector J4 on the



	C3	B3	A3
143	0	0	1
144	0	1	0
145	0	1	1
146	1	0	0
147	1	0	1
148	1	1	0

Fig. 1.



A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

Fig. 2.

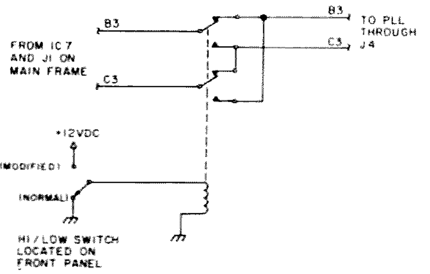


Fig. 3.

PLL board. The red and brown wires on this connector are B3 and C3 coming from J1 and the microprocessor in the remote head. Snip them, leaving enough wire on the J4 side to solder to the relay. They go through J4 to the PLL.

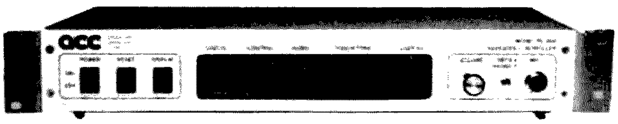
Extend the remaining red and brown wires from J1 a few inches and solder to their respective relay pins.

Remove the remote transceiver head, its cover, and the speaker. Find the open lug on the HI-LOW switch and solder a wire between it and the switched 12 volts on the power switch.

Dress and check all the wiring to the relay and reassemble the transceiver.

By pressing the HI-LOW switch to the LOW position, B3 and C3 lines are reversed. 144 on the display is actually 146. 145 is actually 147. The 100-, 10-, and 5-kHz digits are correct. Notice that 143 and 148 MHz remain unchanged. By releasing the HI-LOW button, normal operation is restored.

I no longer miss all that 146-147 simplex! ■



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11306	22	1.26	1.12	1.02
11307	24	1.41	1.25	1.14
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11205	20	.27	.24	.21
11206	22	.30	.26	.23
11207	24	.33	.30	.25
11208	28	.38	.34	.29
11209	40	.53	.45	.40

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A Gem of an RIT

—customizing the receive on the SB-104

Two or three years ago I bought a new Heath SB-104, and after getting it all together found that I needed some sort of RIT feature. RIT (receiver incremental tuning) can be very helpful in a roundtable when one of the stations in the group is slightly off frequency and you need to tune in the station a little better. When this is done, however, the other station or stations will retune to you, and after a few rounds of this you find everyone has migrated several kilohertz away from the original frequency.

Or—and this is my situation—voice characteristics are such that the other station thinks you should sound a little higher or lower in frequency and the operator retunes slightly. The net effect is the same in both cases, and some means of effecting receiver fine-tuning without changing the transmit frequency is desirable if not necessary.

Heath offers a separate vfo (variable frequency oscillator) so one could get in the one unit the capability of changing a receive frequency without changing the transmit frequency, and be able to operate split frequency in the same band. Split operation is common enough in DXing and in some contests, but for general use it is just another control to manipulate. At first, I used a Kenwood separate vfo with my 104, and since it had built-in RIT, it was used almost exclusively. (For those interested in such a scheme, see my article, "The Heath/Kenwood Connection," *73 Magazine*, April, 1979.)

When a friend wanted my Kenwood vfo for his 520, I began to develop a more direct RIT system, one which could be integrated into the 104's vfo circuit and still not drastically alter the rig's appearance. In the experimenting, I found that not only could I get RIT, but that there was some "fallout" extending into a few other areas which are of interest to amateur operators.

Simple Simple RIT

Designed into the Heath 104 vfo is an LSB (lower sideband) shift system to keep the readout of the operating frequency from changing when going from upper to lower sideband. This is only a nicety since the 104 gives a totally corrected readout of frequency, computed from the various oscillators in the transceiver. LSB shift seems nothing but a carry-over from the days when—mechanical readouts of operating frequency making it necessary—the operator did not have to recalibrate when he changed sidebands on moving from one band to another.

After a little experimentation, I found that the LSB shift signal going into the vfo could be used for RIT. A switching diode is used in this circuit to effectively bring some added capacitance into circuit in the vfo, thereby changing the frequency by a small amount. The total change in frequency on the 104 was 1.9 kHz, and this meant about plus or minus 950 Hz, after

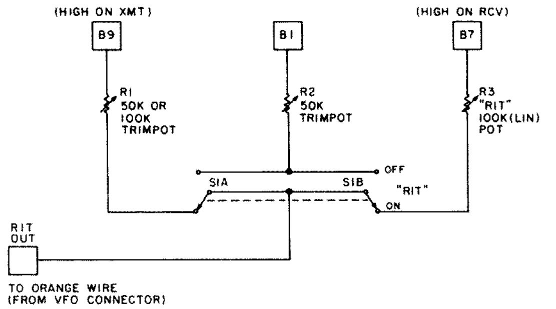


Fig. 1. Simple² RIT.

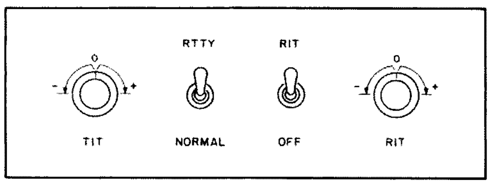


Fig. 2. Deluxe RIT.

the LSB shift cap in the vfo was adjusted so that this much swing could be obtained—quite enough for RIT purposes.

I thought about changing the diode for a varactor diode, etc., and getting more swing, but didn't consider it worthwhile. The vfo is stable, with no drift or warm-up miseries, so I felt it better left alone.

As a general rule, the simpler the circuitry needed to obtain the desired results, the better. So, if you will refer to Fig. 1, you can see the circuit for probably the simplest RIT a person could ever add to a rig. Simple squared! One RIT pot, two trimpots, and a switch!

First, the orange wire coming from the vfo to the LSB mode switch will need to be removed from the mode switch terminal and connected to the operating points of the DPDT switch. (One could even eliminate DPDT switch S1 if desired, since the transceive frequency can be obtained by flipping the mike switch to transmit, noting the readout frequency, then going back to receive and adjusting the RIT control to show the same frequency on the readout. Of course, then, R2, the center frequency adjustment, would not be necessary either. One could drill a hole in the front panel for the RIT pot, the control could be put in place of the VOX gain or delay pots, or it is even possible to replace the VOX delay control with a switch/potentiometer combination. This last option is probably the best method, all things considered, but the VOX delay control would then become a preset control located internally.)

The method selected for mounting the RIT control is up to the installer, of course, and there may be some other way one could mount it that would be even more practical than the one I've suggested.

(It's a shame that the boys at Heath didn't furnish RIT, but if enough people get the message that *all* the oriental dandies have RIT and everyone wants it, then maybe we'll see it come out on the next go-around.)

To adjust the two trimpots in Fig. 1, first swing the RIT pot (R3) from extreme to extreme (CW and CCW) to find the minimum and maximum frequencies. The difference between the two readings is the total swing. Then adjust the pot to mid-position. Turn S1 to OFF so that R2 can also be adjusted to the same reading. Turn to ON and, with mike gain turned completely down, press the PTT (Push-To-Talk) button on the mike and adjust R1 for the same reading on the digital readout. This completes the adjustment. The simple² RIT is now ready to go. Terminal numbers B9, B1, and B7 correspond to board-socket pins of regulator board B.

Deluxe RIT/TIT RTTY Version

At my station, radioteletype also is used. The system is by Microlog, and to be able to use the 104 on RTTY, the receiver must be adjusted to receive 1.6 kHz lower than the transmit frequency. This is because the Microlog receiver is designed to filter and regenerate everything, CW and RTTY, at the CW sidetone frequency.

I could have used the auxiliary input on the Microlog to develop the signal and maintain operation when conditions were optimum, but I would lose the filtering for the whole system. On noisy HF bands you need all the filtering you can get, and the signal conditioning designed into the Microlog is practically unbeatable.

With the new RIT circuit, I could get only 0.9 kHz swing instead of the 1.6 kHz required. So I hit upon the scheme of shifting the

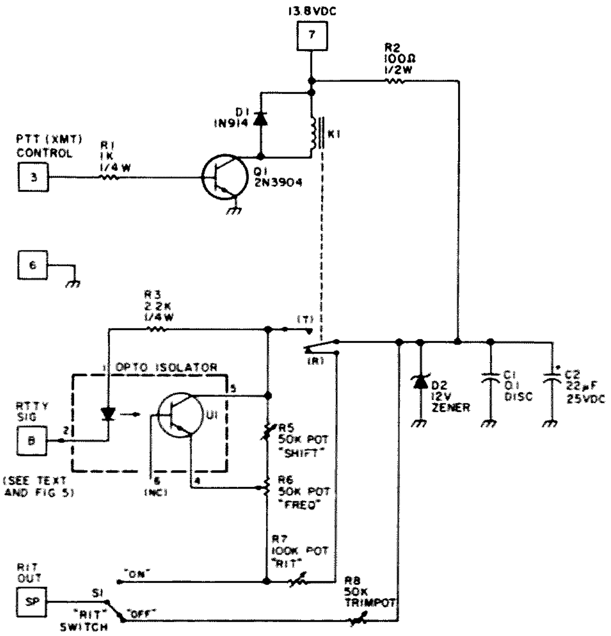


Fig. 3. Deluxe RIT circuit.

transmit frequency by a certain amount and then the receive frequency could be as much as 1.9 kHz away. With 100-Hz accuracy on the frequency readout, I would have total control over the transmit frequency as well as the receive frequency. Now I had RIT and TIT (transmitter incremental tuning).

In Fig. 2, you can see the panel layout for a little box I picked up at the local Radio Shack which is 2" high by 6" wide by 4" deep. A smaller box could have been used, but I'm glad I used this one since I ended up putting several other circuits in it, which I'll describe later.

In Fig. 3, we see the schematic for the deluxe version. It is deluxe because it has the ability to tune the transmitter and receiver incrementally and independently, and the ability to return to basic non-RIT/TIT operation. All parts in this and other circuits in this article are available at Radio Shack, and most of the parts may be substituted for by others if the ones called for aren't immediately available.

For example, the 2N3904 and 2N2222 and other transistors of similar characteristics may be substituted for each other. The 1N914, 1N4148, and 1N4001 diodes may be interchanged since they all will work effectively in the circuits. The same is true for almost all parts used. The 12-volt zener diode is the one part I haven't specified by number since almost any 12-volt zener (½ Watt) will work fine.

The trimpots may be linear or log taper, but the RIT/TIT control pots seem to work best if they are linear. The circuit is not linear across its range, but it is still pretty good except near one end of the pot's rotation. Even then, it's reasonably smooth.

The construction method I used was to mount all parts on a small piece of 100-thousandths-grid perforated board (from Radio Shack, since that's all we have here); then, pigtails from the various controls and switches were attached to the board-mounted components. There was enough strength from the leads so that no mounting problems

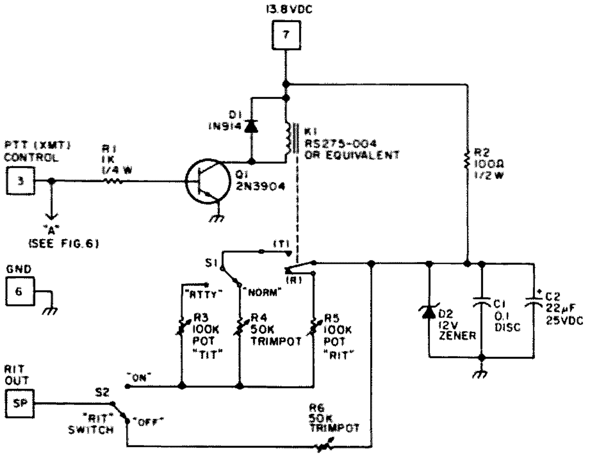


Fig. 4. RTTY circuit.

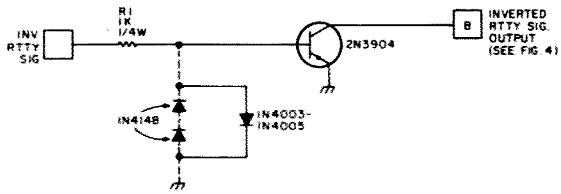


Fig. 5. RTTY flipper.

were encountered. A bit of GE's RTV (or bathroom tile silicone rubber) may be used to secure the board and relay.

The same general procedures may be used for adjusting the various pots (R3 through R6) as was described for the simple RIT circuit. First, adjust R5 (Fig. 3) for center frequency. Then turn RIT switch S2 to OFF and adjust R6 for the same frequency on readout. Turn S2 to ON and then adjust R4 with mike gain turned fully counterclockwise, mike PTT switch on, and S1 in NORMAL. Then check operation of R3 with S1 in the RTTY position. The transmit frequency should vary as indicated by the digital readout. This concludes the calibration and checkout of the circuit.

Resistor R1 in Fig. 3 is in the circuit to limit current in the transistor's base circuit. It also serves to isolate transistor Q1 from the PTT control signal line. Diode D1 keeps the inductive kickback voltage or "flyback" voltage (developed across relay K1's coil by the collapsing field when Q1 turns off) from becoming excessive and possibly "puncturing" Q1's junction, thereby ruining Q1.

Resistor R2 limits current through zener diode D2 to a safe level and allows a voltage difference between D2's 12-volt clamping effect and the 13.8-volt source. Capacitor C1 keeps the zener from generating white noise due to random current paths through the zener's junction. Capacitor C2 is cheap insurance to further guarantee that no possible drive can occur due to any residual instability during transmit.

Numbers inside terminals on the diagram refer to pin numbers of 104's accessory socket. The letters SP indicate a SPARE socket on the back of the 104. Since the deluxe version is basically an external add-on, connections must be made. Therefore, all connections are made to already existing signal and power-supply connections at the accessory socket, and the orange wire (LSB shift on vfo) is then brought out to a spare socket by routing an extension pigtail wire along the cable which runs down the center of the printed circuit board sockets underneath the 104 chassis. Use plastic ties or lacing twine of some kind to secure the wire.

Itty Bitty RTTY

While the information given up to this point is applicable to the vast majority of 104 users, there are enough RTTY freaks around (including myself) who make use of or are interested in possibly using direct RTTY modulation. I've found AFSK (audio frequency shift keying) using the generator kit offered by one of the well-known companies to be the easiest for me to put into service while avoiding any modification to the rig. But since the RIT addition was so available for experimentation, addition of some half-dozen parts to the workhorse circuit of Fig. 3 also gives direct FSK and only costs about $3.00 more.

The circuit of Fig. 4 shows how an optoisolator (Radio Shack #276-1628), a trimpot, and a fixed resistor do this. The tuning procedure is similar to the previous versions except that the shift and frequency pots may interact so that you may have to alternately adjust each pot (R5 and R6) until the desired results are obtained. The digital readout on the 104 makes this fairly easy, but a local "RTTY buddy" should be on hand to let you know how things are going on his set. Of course, it goes without saying that RTTY would be set up and used on lower sideband to be compatible with the normal use of RTTY on HF bands when one is using AFSK. But this system is normally set up and used on the air in the CW mode. Remember: Limit power during tests and operation to about 25 Watts output to save your transistors. More about this later.

The circuit shown in Fig. 4 uses a RTTY signal which normally goes to ground on "make." This is the scheme used with my Microlog keyboard, but in case your system should need the opposite (or an up-going) signal, Fig. 5 shows how another transistor and resistor may be used to get this type of operation going for you. The diodes connected from the base of the transistor to ground, in Fig. 5, may be used if your system has high-voltage switching, in which case the base-current limiting resistor also will need to be changed in value by using Ohm's law and the power law.

With the Microlog system, I was able to use a 2N2222 instead of the optoisolator, but a local friend, Lee KJ5P, told me that he had to use an optoisolator with his Model 15 to keep from getting hum on his transmitted signal. I haven't seen his circuit, but there probably isn't much difference between his circuit and this one. By the way, Lee used his 104 external vfo for the modification, and in doing this was able to avoid opening the 104 itself. The vfo is the same as the internal vfo, circuitwise, so operation still is the same. In my case, I still use AFSK but have the ability of going FSK in a few moments just by switching cables.

Word of mouth has it that the 104 can transmit at 50 Watts output by using a cooling fan on the heat sink's cooling fins (running RTTY). With four transistors good for about 70 Watts dissipation each, this may be very possible, mainly dependent upon the efficiency of the heat-exchange system. However, I've set a limit of 25 Watts output—and this is only when using a cooling fan. With the 104 on low power into a Den-Tron GLA-1000 amplifier, I

get about 65 Watts into the dummy load and this can be done all day without damage to the final transistors or driver transistors. Although protection is built in for the finals, I'd rather play it safe, and 65 Watts is enough for most purposes when you have a good antenna. In high power and very little drive, the GLA-1000 will run 150 Watts output, about the maximum safe level for the amplifier.

A spin-off of the RIT project is that I'm able to use the PTT signal in the RTTY box to key up the amplifier on low power. Heath fixed it so that the 104 may key an amplifier, but the relay keying is done only when in high power. Fig. 6 shows a relay-driver circuit with diodes to protect the transistor from any possible damage from kickback spikes from the relay. With this circuit, I can key the amplifier while on low power.

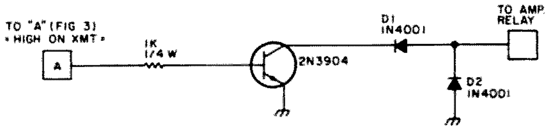


Fig. 6. Amp op.

A call to Benton Harbor gave me some additional information about RIT on the 104. While talking to one of the "supertechs," I found that an engineer there had put RIT in his 104 in some way by using the LSB shift control line to the vfo. (The technician objected, saying that the frequency shifted when changing from USB to LSB; he opined that this was somehow detrimental when changing sidebands. The fact that his boss did it and it worked was for him apparently secondary to design concepts. Perhaps this is a desirable quality in a technician!)

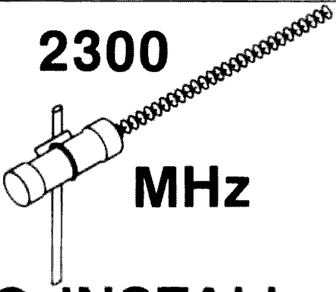
I was also informed that a *QST* article had a circuit for RIT on the 104 requiring one to go into the vfo. I went back into my vfo when converting my 104 to the A model, and it didn't change my opinion that it's better to leave a potential drifter alone! Unless one gets thrills from complexity, simplicity is better, permitting the operator to get it together and going without delays.

Merely taking note of the readout frequency on the 104 and tuning to it when changing sidebands puts you right back on frequency since the 104 computes everything for you. But with the recognized standard of certain sidebands being used for the different bands, when would one need to change sidebands on a particular band (except to prove that it can be done)? In normal usage, this is never done by the operator.

So now you have it. You've seen how it was done and how it can be done and perhaps this has given you some ideas for improving your system. And looking at a schematic of a 104 will show you that only three or four parts are needed in the vfo circuit to shift the frequency. If your rig doesn't have RIT, these few parts, with a little bit of thought and just a little experimentation, could give you RIT and the added versatility—even if your rig isn't a digital marvel like the 104.

Special thanks to Lee KJ5P for his initial experimentation and for proving that it could be done even before I decided to roll my own. I guess you can say we'd both rather be shifters than drifters! ■

ATi



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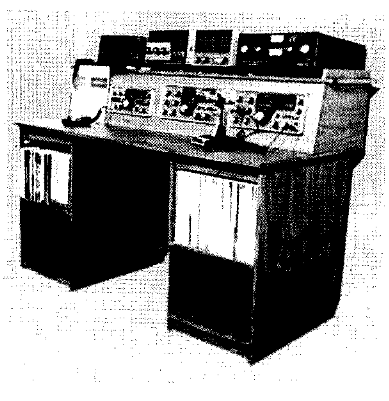

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Protect Your Pass Transistors

—the crowbar connection

After purchasing a Ten-Tec 544 transceiver and matching 262M power supply, I became concerned about the possibility of the pass transistor in the supply shorting and causing damage to the transceiver. If the transistor fails by shorting, approximately 23 volts will be applied to the transceiver.

Others concerned about shorted pass transistors in this and other brands of solid-state equipment have added crowbar SCR or transistor switches to short the output of the supply to ground if the output voltage rises to approximately 15 volts. This worthwhile scheme protects the transceiver, but it leaves one wondering what can be done to reduce the possibility of having a pass transistor fail.

It seems obvious that if the pass transistor can be made to run cooler, it is less likely to fail. Therefore, a simple method of cooling the pass transistor was sought. The instruction manual for this and other transceivers suggests fan cooling for high duty-cycle operations such as RTTY. Fans can be noisy and hard to mount. A more direct method is to reduce the amount of power that must be dissipated by the pass transistor.

Since the amount of power that must be dissipated by the transistor is the product of the current through and the voltage drop across the transistor, lowering either one of these variables would do the job. Lowering the output voltage or current is not acceptable to most operators since it results in reduced output power. The only acceptable change appears to be to reduce the input voltage to the pass transistor while still maintaining normal output current and voltage.

Measurements made on my 544 at full output power on CW on 40 meters showed that with my 120-volt ac line, the input to the pass transistor was 19 volts at a load current of 13 Amperes. Under these conditions, the transistor is dissipating 68 Watts of power. I then connected the ac input of the 262M power supply to a variable ac source, and tests were run to determine how low the nominal 115-volt input could be made while still maintaining excellent voltage regulation at the required current of 13 Amperes.

I found that for my supply, the input could be lowered to 102 volts with only a 0.09-volt reduction in the output voltage! Under these conditions, the pass transistor was only dissipating 28 Watts, a reduction of 40 Watts or 59% over the operation at the full 120-volt condition! Of course, the transistor runs much cooler under these conditions and is less likely to fail. The results of these tests are shown in Table 1.

To take full advantage of this information, one could connect the input of the supply to a continuously adjustable ac voltage source rated at 3 Amperes (for the 544/262M) and reduce the ac voltage until the nominal 13.8-volt output just starts to drop from its no-load value when the transmitter is keyed at full output power.

The "output" pilot lamp on the 262M supply will flicker when this point is reached. Unfortunately, continuously variable ac voltage sources such as Variac or Powerstat autotransformers are expensive and not always readily available, so a different method is used.

As shown in the schematic diagram in Fig. 2, a low-voltage filament transform-

Input, volts ac	Input to pass transistor, volts dc	Output of power supply, volts dc	Power dissipated by pass transistor (Watts)	Power saved over 120-V input condition
120	19	13.76	68	Original
112	17.9	13.76	54	14 W = 20%
108	16.9	13.76	40	28 W = 41%
102	15.8	13.67	28	40 W = 59%
95	14.03	12.72	17	51 W = 75%

Table 1. Pass-transistor dissipation and output voltage vs. ac input voltage for the Ten-Tec 262M power supply. Notes: 1. Load current was 13 Amperes as indicated on Ten-Tec ammeter. 2. All voltages measured with a Fluke 8022 DVM. 3. 95-volt input arbitrarily deemed not an acceptable operating condition. 4. Ac input current to power supply at 120 Vac was 2.5 Amperes. 5. Ac voltages measured at pins on power-supply line cord plug.

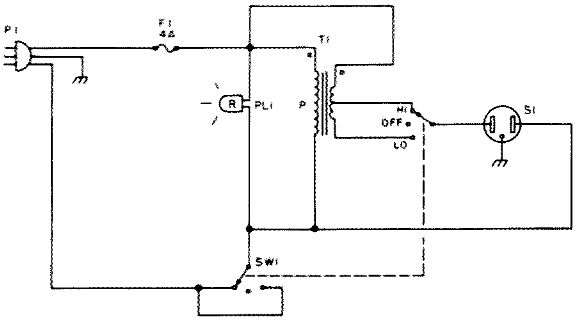

Fig. 1. Schematic of the pass transistor saver. SW1—DPDT toggle switch with center off position; S1—120-volt chassis-mount receptable; T1—Filament transformer, 117/12.6 V c-t at 3 A (Stancor P-8358 or equivalent, see text).

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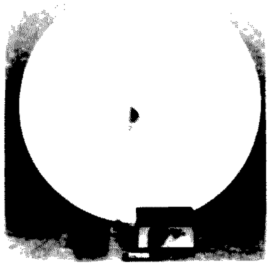

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er is connected in a manner that allows approximately 6.3 or 12.6 volts to be subtracted from the normal supply voltage. At low loads, such as 13 Amperes, the switch is placed in the Low position to subtract 12.6 volts from the ac supply line. At greater load currents, such as 16 Amperes, the switch is placed in the High position to subtract 6.3 volts from the ac supply line.

Table 2 shows the results of tests made when operating the 544 using the filament transformer. When operating at full output power on 40-meter CW, my pass transistor is now dissipating only 26 Watts, a savings of 42 Watts or 62% over full 120-volt line voltage operation. My pass transistor heat sink is now cooler than the heat sink on the transmitter's final output transistors after a full evening's operation.

Since more than 13 Amperes may be required for full output power on other bands, a test was conducted at a load current of 16 Amperes using a filament transformer. The results of this test also appear in Table 2, and show that at least a 40% savings in power dissipation can be realized while still maintaining excellent voltage regulation.

Construction and parts layout is not critical. The unit was constructed on a 2" × 4" × 5" chassis. Proper phasing of the transformer windings is accomplished by the cut-and-try method. If your trial connection causes an increase in output voltage, reverse the secondary leads of the transformer. For safety, make these tests with the transceiver disconnected from the unit. Purists may want to install an additional 1/2-Amp fuse directly in series with the primary of the transformer.

If the normal line voltage at your location is significantly less than 120 volts, such as 110 volts, a 10-volt c-t transformer or even a 6.3-volt c-t transformer may be more suitable than the 12.6-volt unit specified. When selecting a transformer, keep in mind that the output voltage of a filament transformer varies as its load current varies. The output voltage of a transformer rated at, say, 12.6 V at 5 Amps will be more than 12.6 V at currents less than 5 Amps assuming rated primary voltage. Two or more transformers with the secondaries connected in series could be used with a multiple-position selector switch to give a greater number of combinations.

Equipment manufacturers must design their supplies to operate over a wide range of input voltages. If the voltage at your location is on the high end of the scale, or even in the middle, this unit will allow your power supply pass transistor to run cooler while still maintaining good voltage regulation and maximum transmitter output power. This, combined with a crowbar, will reduce the chances of damage to your transceiver and may save you the trouble of locating and replacing a defective pass transistor.■

Switch position	Load current (Amps)	Input to pass transistor, volts dc	Output of power supply, volts dc	Power dissipated by pass transistor (Watts)	Power saved over 120-V input condition	Ac input to power supply, volts
Note 3	13	19.1	13.88	68	Original	120
Low	13	15.8	13.82	26	42 W = 62%	103.7
High	13	17.4	13.88	46	22 W = 32%	112.0
Note 3	16	18.0	13.88	66	Original	120
Low	16	14.7	13.20	24	42 W = 63%	Note 4
High	16	16.3	13.82	40	26 W = 40%	Note 4

Table 2. Results when operating the power supply from the transformer voltage-reducing unit. Notes: 1. A slight flicker could be seen on the 262M power-supply Output light in the Low, 16-Amp condition. 2. These tests were run one week after the tests shown in Table 1. Note that normal output voltage is slightly (0.12 V) higher. 3. None-across-the-line operation for reference. 4. Not measured. 5. Normal line voltage was approximately 120 volts.

✓See List of Advertisers on page 130

All Tied Up in Knots?

—the twisted tale of Thomas J. O'Harra

Glenn Jacobs KC7M
Poverty Flat AZ 85925

My grandfather was Nazario Garcia Baca, and he was the very first radio amateur in all New Mexico. He was also a sheep rancher, and that brings up the most famous knot of all, the "sheepshank." But the sheepshank has nothing whatever to do with sheep, and Grandfather Baca never used one and you will never need one either, so skip it.

The Bowline

My other grandfather, Frank Elmer Jacobs, told me a story about another kind of knot, done on a ham—a ham actor, that is. It seems the good old boys in San Angelo (Texas) wanted to form a vigilante committee like the ones in San Francisco to get rid of a certain Thomas J. O'Harra, alias "Pretty Good Actor." (He had been legally acquitted three times in a row of swindling women by promising to marry them.) The committee had posters printed up, inviting Pretty Good Actor to a pretty good "necktie party."

Well, Pretty Good Actor was hard to bluff, and he was doing a couple of lucrative productions at the time, so he stayed. There was nothing to do but go ahead and hang the man for the glory of Texas and the honor of Texas women. The committee caught him coming out of play practice the very next night. They wanted to hang the man, but not kill him. Instead of the traditional "hangman's knot," they used a "bowline knot." It makes a noose that will not tighten up. By including Pretty's chin in an oversized noose and running the hanging rope up

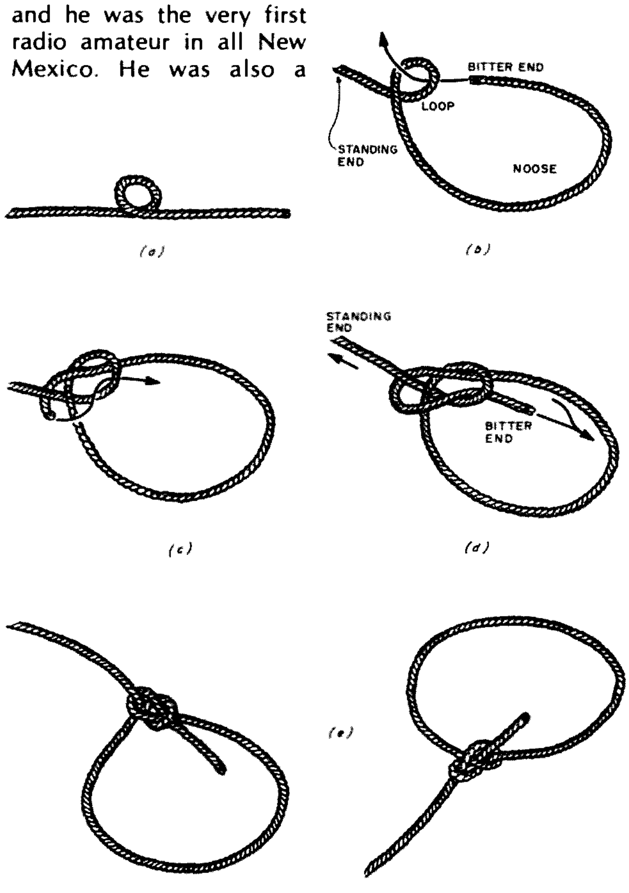
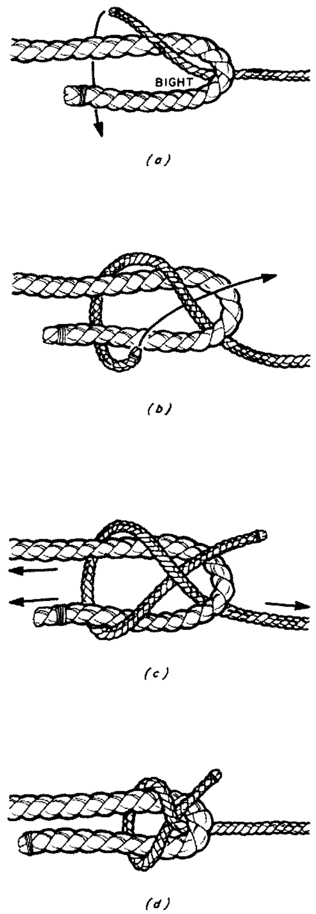


Fig. 1. The bowline. (a) Leave plenty of rope for both the noose and the knot, then form a loop. (b) Pass the bitter end through the loop as if you were tying a simple overhand knot. (c) Now take the bitter end around the standing end and back through the loop. (d) This is a bowline knot. All it needs is tightening in a special way. Notice that the bitter end has merely been folded back on itself. To tighten the bowline, pull the standing end while holding both the bitter end and the other rope that comes out of the same hole. Beware: If you pull it wrong, the knot will "turn inside out" and leave you with a useless slip knot around the bitter end. (e) The front and back of the tightened, finished bowline knot.



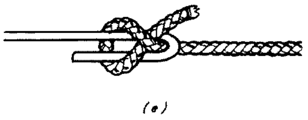


Fig. 2. The sheet-bend. (a) First, bend the stiffer of the two ropes back on itself and stick the floppier rope through the bight. (b) Wrap the light rope around the bight of the heavy one. (c) Weave the light rope over the heavy, under itself, then back over the big one. Tighten the sheet-bend carefully by pulling both parts of the big rope one way and the standing end of the smaller rope the other way. By the way, this knot is also good to join two ropes of the same size. (d) The finished sheet-bend. (Note: This knot is easy to untie.) (e) "Copperweld™-bend" for tying a rope onto stiff antenna wire. The wire is stiffer than the rope, even though it is thinner, so the wire takes the bend and the thicker rope makes the knot.

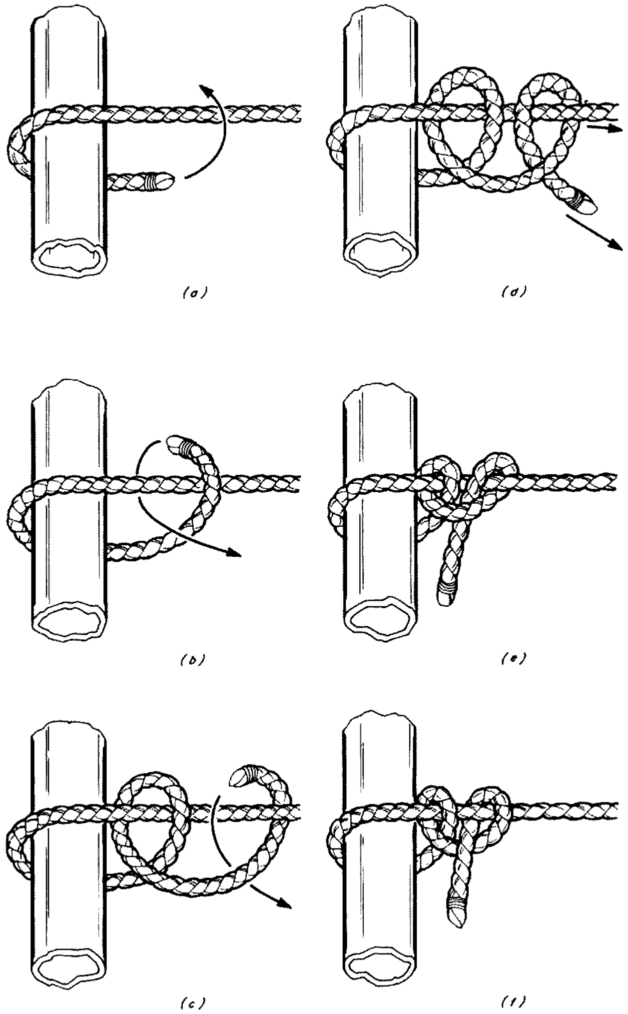


Fig. 3. The double-half-hitch. (a) Wrap the bitter end around the tower leg. (b) Wrap the bitter end around the standing end and poke it through the loop to form the first half-hitch. (c) Now do it again in the other direction to form the other half-hitch. (Note: If you make both half-hitches in the same direction, you get a clove-hitch instead. Either one works just fine.) (d) Just right. Now tighten it by pulling on the bitter end. If the standing cord is not under tension, pull on it, too. (e) The finished double-half-hitch. This can be tied in a rope with a wild horse (or a 160-meter dipole) pulling on the other end. (f) The clove-hitch. It is every bit as good.

beside his nose instead of behind the ear, it did not cut off his air nor the circulation to his head.

The victim swung back and forth and slowly twisted in the night breezes, looking up the rope. The vigilante committee marched away then hid behind a fence and watched, barely able to keep from bursting out laughing. When Pretty Good Actor was convinced they were gone, he fished a knife out of his boot and cut himself down and was never seen again in San Angelo.

Today when I hung up my dipole on the flagpole, I used a bowline for the same reason. I wanted a loop that would not tighten. Also, a bowline is easier to untie than a lot of other knots. See Fig. 1.

The Sheet-Bend

The very useful "sheet-bend" got its present name in the British Navy over three hundred years ago. "Tie onto that big cable," the captain ordered. "Tie it?!" protested the gunner's assistant. "Sir, I can barely bend it." The old name of the sheet-bend was [illegible].

The sheet-bend is really the same knot as the bowline. If you tie two ropes together with a bowline, it is called a sheet-bend. It is particularly useful for tying a little rope to a big one. I used a sheet-bend on each end of my dipole today to attach the nylon ropes to hold it up. You and I might privately call that a "copperweld™-bend," but the sailors and scouts wouldn't recognize it by that name. See Fig. 2.

The Double-Half-Hitch

Why didn't they call this one a "whole-hitch," or just a "hitch"? Anyway, I used it this afternoon to tie the northwest end of my skywire to a tower leg. It is good for that sort of thing, because you can tie it while you are pulling on the rope. See Fig. 3.

The Packer's Hitch

Say you want to pack that triband beam and haul it up the mountain on Field Day. You get it all up on the rack of your cousin-in-law's plumbing truck. Then what? How do you tie it? Just wrap all the rope you own around it? Keep watching in the rear-view mirror for one of those slippery elements to fall out on the road behind you? Fig. 4 shows a little rope-trick that will really hold things together.

Summary

Just any old knot might fail you in a pinch. The bowline will make a noose that will not tighten up. Its cousin, the sheet-band, is good for tying ropes together, even if they are different

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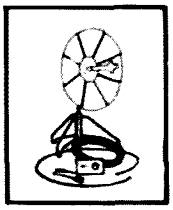

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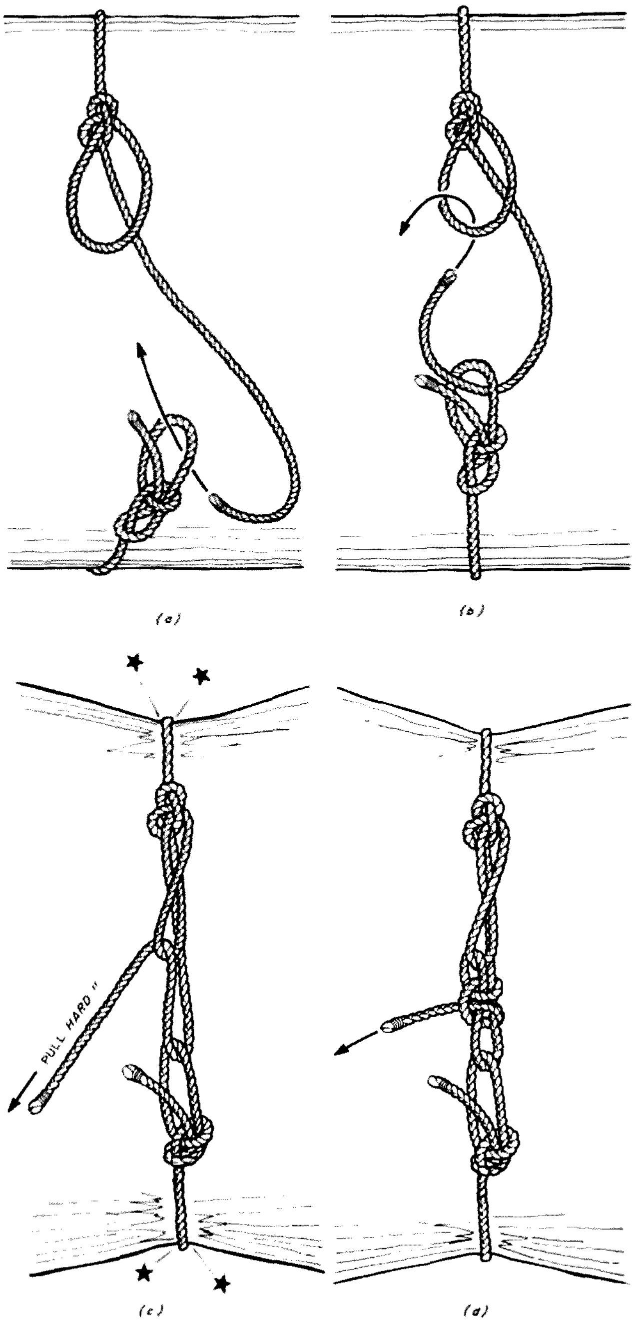


Fig. 4. The packer's hitch. (a) Wrap the rope around your load. Make a bowline at one end of the rope. Make another bowline near the other. Leave plenty of loose rope at the bitter end. (b) Loop the bitter end through both bowlines and pull down hard. (c) Now pull down harder! More! You have a three-to-one mechanical advantage now. Sock it to it! Str-r-e-e-t-ch that rope! (d) Now tie the bitter end around below the bowline with a double-half-hitch.

sizes. The double-half-hitch can be tied on a rope under tension. And the packer's hitch (which is a combination of the bowline and double-half-hitch) will let you put the squeeze on anything you can get a rope around. These special knots are good for passing the Boy Scout Tenderfoot exam and are good for many, many jobs in the Amateur Radio Service.■

Paul Swearingen W9PJF
R.R. #1, Box 485
Benton IL 62812

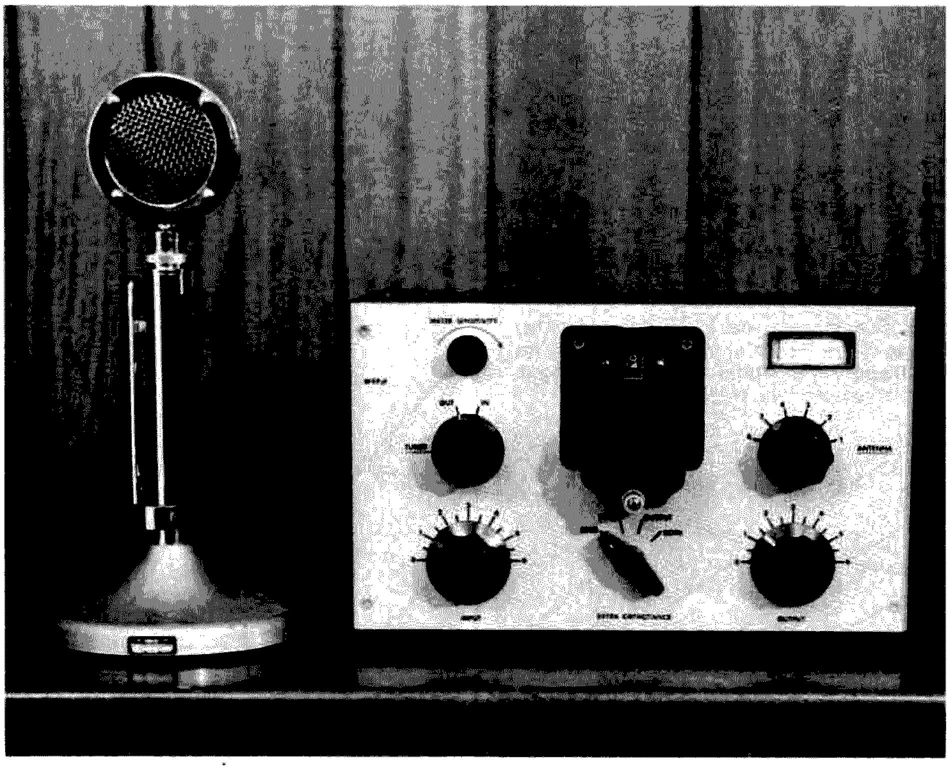
The Coax Matcher

—it may be all the tuner you need

Antenna tuners can be designed to match a wide range of feedline impedances to the low-output impedance of the typical amateur transmitter. Many of the current, commercially-made tuners can be used for coaxial feedlines or for the high-impedance open-wire feedlines. This flexibility of use is not without its price, however, as the high-impedance capability requires the use of wide-spaced, high-voltage capacitors. These capacitors are characterized by their scarcity, large size, and high cost.

If the tuner could be limited to use with low-impedance coaxial feedlines from normal antennas, then a network could be built using tuning capacitors of the closer-spaced variety similar to the loading capacitors in today's linear amplifiers. Fig. 1 is a schematic of such a "coaxial tuner" that I built and use with my HF antennas, which include a tribander for 20, 15, and 10, a quarter-wave vertical for 40, and an inverted vee for 80 meters. My ham gear is the old vacuum-tube type with transmitter input powers of 1200 Watts PEP on sideband and up to 1 kW on CW and RTTY. With the exceptions of the 75-meter phone band and the upper portion of 10 meters, I have no trouble loading the rig with the existing swr's and with no line tuner in use.

I wanted a tuner because I planned to acquire a solid-state transceiver in the near future. Discussions with others about the swr sensitivities of the newer solid-state rigs had made me revise my former negative attitude towards coax tuners or line matchers. A tuner is



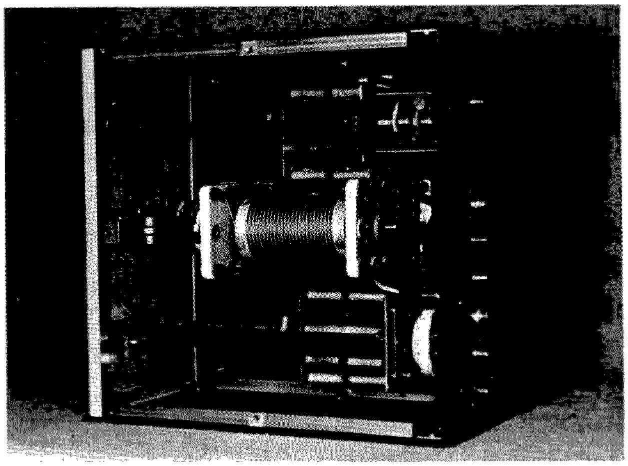
Tuner, with D-104 for size comparison.

certainly a much simpler way of making a solid-state rig happy than trying to find an antenna that presents a constant 52-Ohm load from one end of the band to the other. The coax losses are not decreased, or increased, but the desk may have to be rearranged to accommodate the tuner.

When using the tuner on 75 meters, the 1200-pF variable capacitors did not have enough total capacity, so switch S2 and capacitors C3 and C4 were used to provide an additional 500 pF on the input, on the output, or on both when needed. The in/out switch, S1, is used to remove the tuner from the circuit for those portions of the band where the swr is a reasonable figure. The antenna switch, S3, merely selects the coaxial line of your choice. I use one of the output connectors to feed my dummy load and find this convenient for tune-ups or tests. The rf level meter is to ensure that the tuner is set for maximum output rather than to a false resonance.

The leads connecting the inductor and the variable capacitors should be as short in length and as large in cross-section as you can manage. With my prototype breadboard unit, I could not obtain an swr of 1 to 1 on frequencies above 29.2 MHz and found that, while the inductor had reached its minimum value, I still needed less inductance. Changing from number 14 wire to 3/8" copper strap decreased the lead inductance and cured the problem. Purists may question the open-type switch used to select the various antenna connectors, but the swr meter shows no serious effects. If any undesirable swr effects did occur, they could be corrected by the tuner.

An swr meter should be connected between the transmitter and the tuner so that the tuner can be adjusted properly. This is also the correct place for the power meter since swr's greater than 1 to 1 can give some very odd power readings. Initial tuning adjustments should be made at the lowest power level needed for your particular swr meter. The amount of inductance and capacitance needed will vary from band to band and will depend upon the swr of each antenna, the length of the feedline, and whether you are operating above or below the resonant frequency of the antenna. Initial adjustments may get to be a bit tiresome, so the settings should be logged for future use.



Inside view of tuner.

I recommend that a systematic approach be used in tuning the network as the adjustments are somewhat interactive and a helter-skelter knob-twister could get a bit frustrated. For initial adjustments on any frequency of interest, I first set the inductance so that one turn was in use. Then I varied both the input and output capacitors to find their effect upon the swr. If the swr was still high, I put another turn of the inductor in the circuit and again readjusted the capacitors, looking for a decrease in swr. This process was continued until the desired 1 to 1 swr was obtained.

Fig. 2 is a chart showing the approximate settings I obtained at various frequencies. The feedlines to the beam and to the inverted vee are about 150 feet long. The line to the vertical is about 50 feet long. Swr measurements were taken with a Heathkit HM-102 swr/wattmeter.

The in/out switch and the antenna switch are mounted on aluminum plates which are parallel to and spaced about 2½" from the rear panel. This permitted the wiring of these switches and the antenna connectors prior to final assembly. It did require the use of rather long ¼" shafts to reach the front panel. The small RG-8/M mini-foam coaxial cable from Radio Shack makes the wiring easier than it would be with normal size RG-8/U.

For the wiring between the antenna switch and the coaxial connectors, I used direct, unshielded wire where the switch and connectors were so close that coax would have been awkward or nearly impossible to use. The coaxial con-

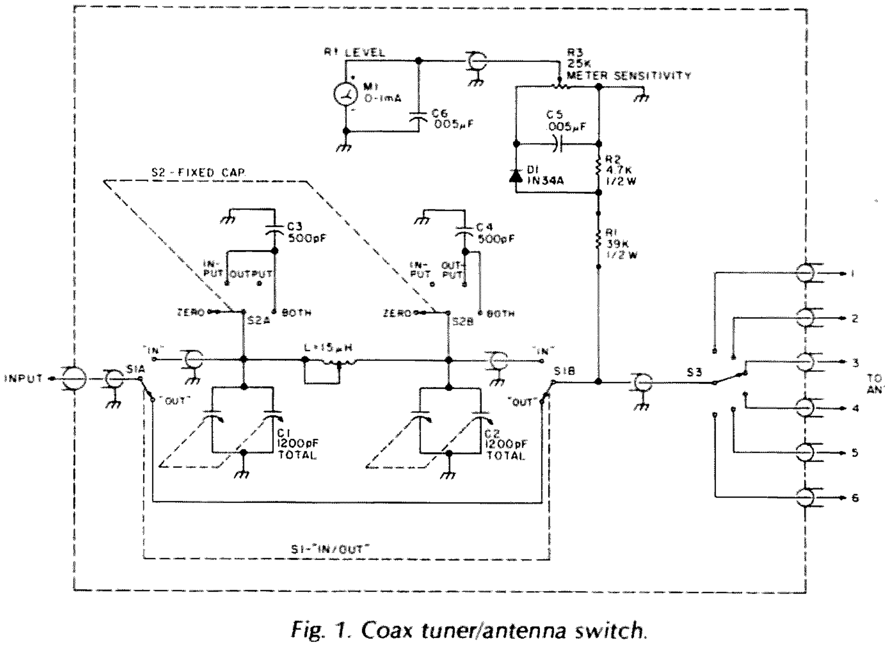


Fig. 1. Coax tuner/antenna switch.

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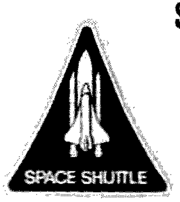

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Parts List

C1, C2	2-gang broadcast receiver-type capacitors, 600 pF per gang
C3, C4	500-pF ceramic or mica transmitting capacitors (high voltage)
C5, C6	.005-uF, 200-V disc
R1	39k, ½ W
R2	4.7k, ½ W
R3	25k pot
L	15-uH variable inductor
D1	1N34A germanium diode
M1	0-1 milliammeter
S1	DPDT ceramic wafer switch, two section
S2	DP4-position ceramic wafer switch, two section
S3	SP multiple position, to match number of connections required

Cabinet pictured—Moduline 7-12-12

nectors are mounted in a straight line across the rear panel. A much better arrangement would be to mount them in a circle so that very short direct leads could be used between the antenna switch and the respective connectors.

The rf voltmeter voltage-divider/rectifier components are mounted on a terminal strip near the in/out switch since this was a convenient location to sample the rf voltage. The B & W #3852 inductor has a total of 24 turns of wire and its inductance of 15 uH is more than is needed. Ones with maximum inductances of 7-10 uH would probably do as well and would probably be much smaller physically.

Parts procurement is always a problem for the builder, even for simple projects like this tuner. Surplus dealers are likely to have suitable variable capacitors, switches or switch sections, and perhaps variable inductors. Exact duplicates are not necessary. Capacitors with 4 gangs each and totalling about 1800 pF would be great as they would allow the elimination of C3 and C4 along with switch S2. A tapped coil could be used instead of the rotary coil. If so, I recommend a tap each half turn at the low-inductance end of the coil for about 4 taps or so, as the 10-meter inductance values may be quite small and a change of a whole turn at a time may miss the best spot. Better yet would be to make the last tap experimentally after assembly and near any problem frequency encountered. Cabinets are now rather expensive items, so home-brew or surplus ones may be a good choice. Many turns-counting dials are available commercially. The one pictured is an old surplus B & W #11282 of ancient vintage.

I used light grey spray paint on the front panel and identified the controls with press-on lettering. A few light coats of clear plastic spray paint were then applied to protect the finish. Switches S1 and S2 were assembled from ceramic wafers from my junk box and I used two wafers each to provide some isolation between sections. Switch S3 is a husky switch from a surplus BC-375 antenna-tuning unit. The knobs were also resurrected from my junk-box assortment.

A final word of caution: This coaxial tuner is not designed for wide variations in load impedance. If you have a shorted trap in your tribander beam and an swr of 10 to 1, this tuner will not correct your problem. It is not suitable for use with open-wire line. High-load impedances *cannot* be matched without developing high voltages across the capacitors with consequent arcing and damage. The tuner is capable of tuning out the reactance of coaxial cables feeding normal, resonant antennas and can present an apparent swr of 1 to 1 to the rig.■

Ant Resonance MHz (swr)	Test Freq MHz	Swr without tuner	Tuner Values for 1:1 Swr: Input C pF	Inductance (# turns used)	Output C pF
3.66	3.505	3++:1	600	5T	940 + 500 FIXED
(1.3:1)	3.950	3++:1	800 + 500 FIXED	3.8T	1080
7.20	7.005	1.4:1	800	4.3T	740
(1.1:1)	7.295	1.2:1	740	4.3T	720
14.10	14.005	1.8:1	680	2T	620
(1.15:1)	14.345	2:1	720	2T	620
21.10	21.005	1.15:1	100	1.9T	200
(1:1)	21.440	1.8:1	100	2.3T	200
28.5 (1.1:1)	28.005	1.3:1	0	1.3T	160
	29.100	2.9:1	200	1.4T	0
	29.600	3++:1	260	1.7T	320

Fig. 2. Representative tuner settings.

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received at 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458.

CORNWALL NY
OCT 2

The Orange County ARC will hold its annual auction on Saturday, October 2, 1982, from 10:30 am to 2:30 pm, at Munger Cottage, Cornwall NY. Sellers will be admitted at 9:00 am. Admission is $1.00. Talk-in on 146.52. For further information, call Bill N2CF at (914)-928-6288.

SYRACUSE NY
OCT 2

The Radio Amateurs of Greater Syracuse (RAGS) will hold their annual hamfest on Saturday, October 2, 1982, from 9:00 am to 6:00 pm at the Art and Home Center, New York State Fairgrounds, Syracuse NY. There will be commercial exhibitors and a large indoor flea market. Breakfast and lunch will be served. Door prizes, tech talks, a program on DXpeditions, women's activities, entertainment, and various contests will be featured. Admission is $3.00 and indoor flea-market space will also be available. Talk-in on .90/.30 and .31/.91.

ANNISTON AL
OCT 2-3

The Calhoun County Amateur Radio Association will hold its 3rd annual Anniston Hamfest on Saturday and Sunday, October 2-3, 1982, at the City Auditorium, Anniston AL. On Saturday, doors will be open from 9:00 am to 5:00 pm; on Sunday, from 9:00 am to 2:00 pm. Exhibitors may begin setting up at 7:00 am both days. Admission is free, as well as coffee, bingo, and parking for self-contained RVs. The FCC will administer exams. Talk-in on 147.69/.09 and 146.10/.70. For more information and reservations, contact Dale Boothe KA4LRL, 3430 Greenwood Avenue, Anniston AL 36201.

BOXBORO MA
OCT 2-3

The Federation of Eastern Massachusetts Amateur Radio Associations will hold the New England ARRL Convention on October 2-3, 1982, at the Sheraton Boxboro Hotel, Route 495 at Route 111, Boxboro MA. On Saturday the hours will be 9:00 am to 5:00 pm and on Sunday, 10:00 am to 5:00 pm. Early-bird registration is $4.00. The Saturday evening banquet, dance, and show is $13.50. Features will include a Wouff Hong midnight ceremony Saturday and YL programs on both days. For reservations and advance registration, send an SASE to Arthur Tomkinson W1THT, 9 Oliver Terrace, Revere MA 02151 and make checks payable to FEMARA.

WARRINGTON PA
OCT 2-3

The Pack Rats sixth annual Mid-Atlantic VHF Conference will be held on Saturday, October 2, at the Warrington Motor Lodge, Rte. 611, Warrington, PA. Advance registration $3.00; at the door, $4.00. Price includes admission to the 11th annual Pack Rats Hamarama on Sunday, October 3, at the Bucks County Drive-In Theater, Rte. 611, Warrington, PA. Admission to the flea market $2.00 and tailgating $4.00 per space. Bring your own table. Gates open at 7:30 am. Talk-in via W3CCX on 146.52. Information for both events is available from Hamarama '82, POB 311, Southampton PA 18966 or Lee A. Cohen K3MXM at (215)-635-4942.

ROCK HILL SC
OCT 3

The York County Amateur Radio Society will hold its 31st annual hamfest on Sunday, October 3, 1982, at Joslin Park, Rock Hill SC, starting at 0700. Pre-registration is $3.00; at the gate, $4.00. There will be prizes. Talk-in on 146.43/147.03 and 146.52. For additional information, contact YCARS, Box 4141 CRS, Rock Hill SC 29730.

YONKERS NY
OCT 3

The Yonkers Amateur Radio Club will hold its electronics fair and flea market on Sunday, October 3, 1982, from 9:00 am to 5:00 pm, rain or shine, at Yonkers Municipal Parking Garage, corner of Nepperhan Avenue and New Main Street. Admission is $2.00 each; children under 12 will be admitted free. Sellers' spaces are $6.00 (bring your own table) and include one admittance. Gates will be open to sellers at 8:00 am. There will be live demonstrations, hourly prizes, an auction, free parking, refreshments, and unlimited free coffee all day. Talk-in on 146.265/146.853, .52, or CB channel 4. For further information, write YARC, 53 Hayward Street, Yonkers NY 10704, or phone (914)-969-1053.

SAN ANGELO TX
OCT 3

The San Angelo Amateur Radio Club will hold its annual swapfest on Sunday, October 3, 1982, starting at 8:00 am, at the clubhouse adjacent to Mathis Field, San Angelo TX. Pre-registration tickets are $4.00 and tickets at the door are $5.00. There will be a bar-b-que served on the grounds and door prizes. Talk-in on .34/.94. For more information, contact Mark Haskell, Rte. 3, Box 92, San Angelo TX 76903.

ROME GA
OCT 3

The 1982 Rome Hamfest will be held on Sunday, October 3, 1982, from 9:00 am to 4:00 pm, at a new location, the Rome Civic Center, Turner McCall Boulevard (US 27 and GA 20), Rome GA. Features will include a barbecue and ladies' prizes. Talk-in on 147.90/.30. For more information, contact Buddy Waller NO4U, 18 London Lane, SE, Rome GA 30161.

GRAND LEDGE MI
OCT 3

The Central Michigan Amateur Radio Club will hold Ham-Fair '82 on October 3, 1982, starting at 8:00 am, at the Grand Ledge High School, Grand Ledge MI (7 miles west of Lansing). Registration for adults is $2.50. Tables are 75¢ per foot. There will be ham gear, accessories, computers, electronic equipment for the home, prizes, demonstrations, a swap shop, a cafeteria, and parking. Talk-in on .34/.94 and .52. For more information, write Ham-Fair '82, PO Box 10073, Lansing MI 48910, or call (517)-626-2237.

MT PROSPECT IL
OCT 3

The Mt. Prospect Amateur Radio Club and Cook County ALERT will hold RA-COM '82 on October 3, 1982, at Prospect High School, 801 W. Kensington, Mt. Prospect IL. Advance tickets are $1.50 and tickets at the door are $2.00. Doors will open at 8:00 am. There will be a large indoor electronics flea-market area, commercial exhibits, seminars, door prizes, and more. Talk-in on 146.52. For more information or reservation forms for flea-market or commercial booths, send an SASE to RA-COM, PO Box 89, Mt. Prospect IL 60056.

SANTA CRUZ CA
OCT 8-10

The Santa Cruz County Amateur Radio Club will host the 1982 Pacific Division Convention on October 8-10, 1982, at the Holiday Inn, 611 Ocean Street, Santa Cruz CA. Full registration is $25.00 and includes the Sunday banquet, the ladies' program with lunch, all Friday evening events, and all forums and technical talks. Registration for forums and talks only is $7.00. Booths are $100. Friday evening events include exhibits, a league session, and a hospitality room. For more information, please write SCCARC Convention, PO Box 238, Santa Cruz CA 95061, or phone (408)-426-6691.

ASHEVILLE NC
OCT 9

The Western North Carolina Amateur Radio Society will hold its seventh annual Autumnfest on October 9, 1982, at the Asheville Civic Center, Asheville NC. Admission is $3.00 in advance and $4.00 at the door. Flea market tables will be $5.00 at the door. Activities (all indoors) will include the McElray Memorial CW Competition, bingo for the ladies, and dealer and flea market tables. Travel, motor home, and camping facilities will be available. Talk-in on .31/.91, .16/.76, and .52. For more information, contact WCARS, PO Box 1488, Asheville NC 28802.

PARK RAPIDS MN
OCT 9

The Headwaters Amateur Radio Club will hold a hamfest on October 9, 1982, from 9:00 am to 5:00 pm, in the Middle School Gym, Park Rapids MN. Admission is $2.00, display tables are $3.00 each, and commercial companies are $5.00 each. Refreshments and prizes will be available. Talk-in on 147.300 and 147.900.

MEMPHIS TN
OCT 9-10

The Memphis Hamfest will be held on October 9-10, 1982, in the Mid South Building at the Memphis Fairgrounds, Memphis TN. Children under 14 will be admitted free. The hours will be from 8:00 am to 4:00 pm on Saturday and 8:00 am to 2:00 pm on Sunday. The deadline for flea-market and dealer setups is 9:00 pm on Friday. Activities will include forums, ladies' programs, and a Saturday night hospitality party. There will be on-site trailer hookups available. Talk-in on .28/.88 and .25/.85.

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VIRGINIA BEACH VA
OCT 9-10

The ARRL Virginia State Convention and Tidewater Computer Show-Hamfest-Electronic Flea Market will be held on Saturday and Sunday, October 9-10, 1982, from 9:00 am to 5:00 pm both days, at the pavilion in Virginia Beach VA. Admission is $3.50 for both days. Flea-market tables are $5.00 for one day or $8.00 for both days; commercial flea-market tables are $15.00 for both days, and commercial booths are $30.00 for both days. Featured will be dealers, special displays, forums, computers, satellite equipment, special XYL programs, and a cocktail party Saturday night. There will be an advance ticket drawing for a hand-held transceiver, as well as many valuable door prizes. For more information and/or tickets, contact Jim Harrison N4NV, 1234 Little Bay Avenue, Norfolk VA 23503, or phone (804)-587-1695.

BEDFORD IN
OCT 10

The Hoosier Hills Ham Club will hold its 21st annual Hoosier Hills Hamfest on Sunday, October 10, 1982, at the Lawrence County 4-H Fairgrounds, 4 miles southwest on US Highway 50, Bedford IN. Registration is $3.00 per person and the swap shop is $2.00 (bring your own tables). The gate will open at 10:00 am on Saturday, October 9th, for campers and flea market setups (registration required). There will be a free fish fry, campfire, entertainment, coffee, and overnight camping on Saturday night. Features will include prizes, ladies' free bingo, and food served at the hamfest all day Sunday. Talk-in on 146.13/.73. For further information, contact Dick Reistter KA9JTZ, Secretary, Hoosier Hills Ham Club, Box 891, Bedford IN 47421.

PARAMUS NJ
OCT 10

The Bergen ARA will hold a ham swap 'n sell on October 10, 1982, from 8:00 am to 4:00 pm, at Bergen Community College, 400 Paramus Road, Paramus NJ. Buyers will be admitted free and sellers will be charged $3.00. There will be tailgating only; bring your own table. Thousands of spaces will be available. Talk-in on .79/.19 and .52. For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

LIMA OH
OCT 10

The Northwest Ohio Amateur Radio Club will hold its sixth annual hamfest on Sunday, October 10, 1982, at the Allen County Fairgrounds, Lima OH. Indoor flea market tables will be available for $5.00 for an 8-foot table or $3.00 for half a table. Tickets are $2.50 in advance, $3.00 at the door. Doors will open at 6:00 am and grand prizes will be drawn at 3:00 pm. Overnight camping will be available at the fairgrounds. Talk-in on .07/.67, .63/.03, .34/.94, and .52/.52. For more information, write NOARC, Box 211, Lima OH 45802.

BALTIMORE MD
OCT 10

The Columbia Amateur Radio Association will hold its 6th annual hamfest on Sunday, October 10, 1982, from 8:00 am to 3:30 pm, at the Howard County Fairgrounds (15 miles west of Baltimore, just off I-70 on Rt. 144, 1 mile west of Rt. 32). Admission is $3.00, tables are $6.00, tailgating is $3.00, and indoor tailgating is $5.00. Food will be available and prizes will be awarded. Talk-in on 147.735/.135 and 146.52/.52. For table reservations or information, write Sue Crawford, 6880 Mink Hollow Road, Highland MD 20777, or phone (301)-286-3805.

WAUKESHA WI
OCT 10

The Kettle Moraine Radio Amateur Club will hold its annual Ham, Computer, Video Fest on Sunday, October 10, 1982, at the Waukesha County Expo Center, Highways F and FT, Waukesha WI. Tickets are $2.00 in advance and $3.00 at the door. Tables are $3.00 for each 4-foot length; reservations will be accepted until October 1, 1982. Since all facilities will be indoors, the hamfest will be open rain or shine, beginning at 8:00 am. There will be prizes, food, commercial exhibitors, a "happy hour," and free parking. For table reservations, send a check payable to KMRA Club, PO Box 411, Waukesha WI 53187.

NEW ORLEANS LA
OCT 16-17

The New Orleans hamfest-computerfest, Amacom '82, will be held on October 16-17, 1982, at a new location, Delgado Community College, near City Park, New Orleans LA. Admission is $3.00 per person over 12 years old. There will be exhibitors, a flea market, forums, ladies' activities, prizes, and a discussion on international broadcasting by the owner of the nation's only commercial shortwave radio station. Amateur radio tests will be given Saturday morning by the FCC. Talk-in on 147.285/.885 and 449.0/444.0. For more information, and reservations for FCC tests, write W. D. "Bill" Bushnell WA5MJM, Amacom Chairman, c/o Jefferson Amateur Radio Club, PO Box 73665, Metairie LA 70033, or phone (504)-887-5022.

ANDERSON IN
OCT 17

The Madison County Amateur Radio Club of Anderson IN will have a hidden transmitter hunt on October 17, 1982. The starting point will be the Mounds State Park near Anderson. Prizes will be awarded. For more information, contact Frank Dick WA9JWL, 921 Isabelle Drive, Anderson IN 46013, or phone (317)-642-1237.

CHICAGO IL
OCT 17

The Chicago Citizens Radio League will hold its first annual hamfest on October 17, 1982, at the North Shore American Legion Post, 6040 N. Clark, Chicago IL from 7:00 am to 4:00 pm. Due to limited table space, table reservations must be made in writing to Fred Marlette KA9FUO 1851 W. Chase, Chicago IL 60626.

CHELSEA MA
OCT 17

The 19-79 Repeater Association of Chelsea MA will hold its annual flea market on Sunday, October 17, 1982, from 11:00 am to 4:00 pm (sellers admitted at 10:00 am), at the Beachmont VFW Post, 150 Bennington Street, Revere MA. Admission is $1.00. Sellers' tables are $6.00 in advance and $8.00 at the door, if available. Talk-in on .19/.79 and .52. For table reservations, send a check to 19-79 Repeater Association, PO Box 171, Chelsea MA 02150.

CHATTANOOGA TN
OCT 23-24

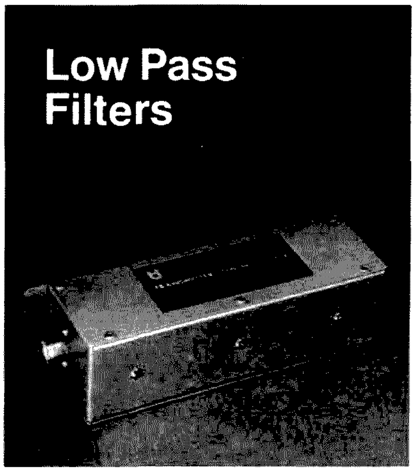
The Tennessee State ARRL Convention will feature Hamfest Chattanooga, to be held on October 23-24, 1982 at Chattanooga State Technical Community College, Amnicola Highway, Chattanooga TN. Admission is free. There will be top prizes, acres of free parking, indoor and outdoor flea markets, and a spacious dealer area inside the physical education building. Other features will include a hospitality party, a Woufl Hong ceremony, ladies' and children's activities, and a cafeteria serving breakfast and lunch. Talk-in on 146.19/.79. For further information, write Hamfest, PO Box 3377, Chattanooga TN 37404.

SAVANNAH GA
OCT 23-24

The Amateur Radio Club of Savannah will hold a hamfest on October 23-24, 1982, at the National Guard Armory, Eisenhower Drive, Savannah GA. Tickets are $2.50 in advance and $3.00 at the gate. Tables are $7.00 for the first table and $5.00 for additional tables. There will be dealers, door prizes, a flea market, and refreshments. Talk-in on .37/.97 and .28/.88. For further information, write Amateur Radio Club of Savannah Hamfest, PO Box 13342, Savannah GA 31406.

FRAMINGHAM MA
OCT 31

The Framingham Amateur Radio Association, Inc., will hold its 7th annual fall flea market on Sunday, October 31, 1982, at a new and larger location (diagonally across from the previous location) at the Framingham Civic League Building, 214 Concord Street (Route 126), downtown Framingham MA. Doors will open at 10:00 am but sellers may begin setting up at 8:30 am. Admission is $2.00; tables are $10.00 and pre-registration



Eliminates or greatly reduces interference to TV receivers by radio amateur stations when installed in antenna lines of those transmitters. Input and output impedance 50 ohms. Insertion loss .3 dB max. VSWR 1.2:1
Attentuation greater than 80 dB from 54 Mhz to 216 MHz (Typically 90-100 dB on Channel 2)
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  PASCAL SOFTWARE DISK = $20.00
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is strongly encouraged. There will be radio equipment, computer gear, food, and bargains. Talk-in on .75/.15 and .52. For more information, contact Ron Egalka K1YHM, 3 Driscoll Drive, Framingham MA 01701.

MARION OH
OCT 31

The Marion Amateur Radio Club will hold its 8th annual Heart of Ohio Ham Fiesta on Sunday, October 31, 1982, from 0800 to 1600 hours, at the Marion County Fairgrounds Coliseum, Marion OH. Tickets are $3.00 in advance and $4.00 at the door. Tables are $5.00. Features will include prizes, a large parking area, and food. Talk-in on 146.52, 147.90/.30, or 223.34/224.94. For more information, tickets, or tables, contact Paul Kilzer W8GAX, 393 Pole Lane Road, Marion OH 43302.

SELLERSVILLE PA
NOV 7

The R. F. Hill ARC will hold its 6th annual hamfest on November 7, 1982, in the Sellersville National Guard Armory, Sellersville PA. Doors will open at 7:00 am for sellers and 8:00 am for buyers. There will be prizes, refreshments, and heat. Talk-in on .28/.88 and .52. For further information, contact R. F. Hill ARC, Box 29, Colmar PA 18915.

CONCORD NC
NOV 7

The Cabarrus Amateur Radio Society, Inc., will hold its annual hamfest on November 7, 1982, from 9:00 am to 5:00 pm, at the Concord Boys Club, Spring Street, Concord NC. Admission tickets are $2.50 in advance, $3.00 at the door. Flea-market tables are $4.00; table space is $2.50. There will be prizes, bingo for the ladies, speakers, and forums. Hot food, beverages, and free parking will be available. Talk-in on 146.655. For advance tickets, flea-market tables, or space, send a check to CARS, PO Box 1290, Concord NC 28025.

NORTH HAVEN CT
NOV 7

The Southcentral Connecticut Amateur Radio Association's (SCARA's) third annual electronics flea market will be held on Sunday, November 7, 1982, indoors at the North Haven Recreation Center on Linsley Street in North Haven CT. Regular admission is $1.25; children under 12 with an adult will be admitted free. Sellers' spaces are $6.00. The best spaces will be assigned first. A limited number of free tables will be provided to the first reservations received. When those tables are gone, space will be available for selling from the floor or from your own table. Food will be available. Sellers may set up at 8:00 am, and walk-ins will be admitted from 9:00 until 3:00. For reservations, send check or money order payable to "SCARA" to Ed Goldberg WA1ZZO, 433 Ellsworth Avenue, New Haven CT 06511. Include an SASE for confirmation.

BANGKOK THAILAND
NOV 12-14

The Radio Amateur Society of Thailand (RAST) will hold the 12th annual South East Asia Network Convention (SEANET 82) on Friday, Saturday, and Sunday, November 12-14, 1982, at the Imperial Hotel, Bangkok, Thailand. There will be lectures, discussions, and commercial exhibits. For more details, contact RAST Secretary, PO Box 2008, Bangkok, Thailand.

NEWMARKET ONT CANADA
NOV 13

The York Region ARC will hold its annual flea market on Saturday, November 13, 1982, from 0800 to 1400 EST, at the Newmarket Community Centre, Newmarket, Ontario. Doors will open at 0630 for exhibitors. General admission is $2.00 (children will be admitted free of charge if accompanied by an adult). Refreshments will be available. Exhibitors' tables are $2.00 each. Talk-in on 142.52 (VE3YRA) and 147.225/.825 (VE3YRC).

FORT WAYNE IN
NOV 14

The Allen County Amateur Radio Technical Society, Inc. (AC-ARTS), will hold the 10th annual Fort Wayne Hamfest on November 14, 1982, at the Allen County Memorial Coliseum, Fort Wayne IN. Admission is $2.50 in advance and $3.00 at the door; children under age 11 will be admitted free. Regular tables are $6.00 and premium tables are $20.00. The Coliseum charges a $1.00 parking fee. Doors will open to the general public at 8:00 am and for vendor setups at 5:00 am. For further ticket or table information, write Becky Skinner KA9GWE, 9720 Pinto Lane, Fort Wayne IN 46804.

GREENSBORO NC
NOV 27-28

The Greensboro Amateur Radio Club will hold the second annual Greensboro Hamfest on November 27-28, 1982, at the National Guard Armory, Greensboro NC. The hours will be 9:00 am to 5:00 pm on November 27th and 9:00 am to 3:00 pm on November 28th. Pre-registration before November 12, 1982, is $3.00 and registration at the door is $4.00. There will be tables and tailgating available. Talk-in on 145.25, .19/.79, and .52. For pre-registration (please include an SASE) or more details, contact Russ Brandt KE4KL, 1301 Dayton Street, Greensboro NC 27407.

STONY BROOK LI NY
NOV 28

The Radio Central Amateur Radio Club will hold its fourth annual Ham-Central, 1982 edition, on Sunday, November 28, 1982, in the main social hall of Temple Isaiah, 1404 Stony Brook Road, Stony Brook LI NY (about 50 miles east of New York City). Doors will open at 7:30 am for sellers and dealers and at 8:30 for the general public. Admission is $2.00 and XYLs and children under 12 will be admitted free. Nine-foot tables are $5.00 each and half tables are $3.00. Features will include an updated antenna lecture by Art (W2LH) and Madeline (W2EEO) Greenberg, door prizes, and home-cooked hot food and drinks. Talk-in on 144.550/145.150 (WA2UEC) and 146.52. For additional information, maps, and advance reservations, contact Scotty Policastro KA2EQW, 80 7th Street, Bohemia NY 11716, (516)-589-2557; or Bob Yarmus K2RGZ, 3 Haven Court, Lake Grove NY 11755, (516)-981-2709.

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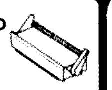

cam actuated, true zero insertion - tin plated solder tail pins - capable of being plugged into dip sockets, including wire wrap

Stock No	No Pins	1-24	25	50
11055	24	$ 4.35	$ 3.90	$ 3.60
11056	28	4.50	4.05	3.75
11057	40	5.95	5.35	4.95
11058	64	10.50	9.45	8.70

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Stock No. 82506 10 ea. of 150K-180K-220K-270K-330K-390K-470K-560K-680K- 820K-OHM
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12098	$1.28	$1.12	$.95

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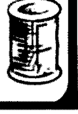


Stock No	Dia	Length (feet)	Weight (oz.)	Price
50075	.062	9	1.5	$3.28
50076	.062	25	4	4.36
50077	.062	50	8	6.02
50078	.032	33	1.5	4.08
50079	.032	88.5	4	5.16
50080	.032	175	8	6.82

TI WIRE WRAP SOCKETS

Tin plated phosphor bronze contact - 3 wrap

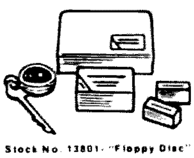
Stock No.	No Pins	1-24	25	100
11301	8	$ .45	$ .40	$ .36
11302	14	.66	.59	.54
11303	16	.72	.64	.58
11304	18	.82	.73	.66
11305	20	1.11	.99	.90
11306	22	1.26	1.12	1.02
11307	24	1.41	1.25	1.14
11308	28	1.71	1.52	1.38
11309	40	2.31	2.05	1.86

TI LOW PROFILE SOCKETS

Tin plated phosphor bronze contact pins with gas tight seal

Stock No.	No Pins	1-24	25	100
11201	8	$.15	$.13	$.12
11202	14	.18	.15	.14
11203	16	.21	.18	.16
11204	18	.24	.21	.19
11205	20	27	.24	.21
11206	22	.30	.26	.23
11207	24	.33	.30	.25
11208	28	.38	.34	.29
11209	40	.53	.45	.40

ELPAC POWER SUPPLIES - DC/DC CONVERTERS



SINTEC Stock No 300 MW Type	ELPAC No	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (MA)	Dimensions (HxWxD) in inches	Price
13825	CB3801	3.0-7.0	12±0.8	0.25	.48x.51x3.05	$ 7.95
13826	CB3811	3.0-7.0	12±0.8	0.25	.48x.51x3.05	7.95
13827	CB3802	3.0-7.0	15±0.7	0.20	.48x.51x3.05	7.95
13828	CB3812	3.0-7.0	15±0.7	0.20	.48x.51x3.05	7.95
13829	CB3804	3.0-7.0	28±0.7	0.10	.48x.51x3.05	7.95
13830	CB3814	3.0-7.0	28±0.7	0.10	.48x.51x3.05	7.95
1.5 W TYPE						
13831	CL3801	4.0-7.0	12±0.6	125	.651x1.2x1.77	59.95
13832	CL3811	4.0-7.0	12±0.6	125	.651x1.2x1.77	59.95
13833	CL3802	4.0-7.0	15±0.7	100	.651x1.2x1.77	59.95
13834	CL3812	4.0-7.0	15±0.7	100	.651x1.2x1.77	59.95
13835	CL3804	4.0-7.0	28±1.4	50	.651x1.2x1.77	59.95
13836	CL3814	4.0-7.0	28±1.4	50	.651x1.2x1.77	59.95

13825-1 DATA SHEET FOR DC/DC CONVERTERS 25

Stock No. 13801- "Floppy Disc" Power Supply For Winchester Drives **$109.00**

13801-1 Data Sheet for 13801 $.25

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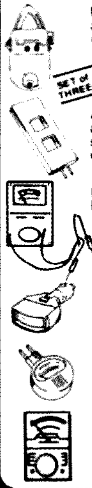

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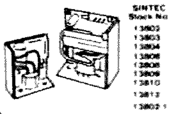
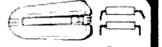


SINTEC Stock No	ELPAC Part No	Output Voltage	Output Current Rating	Dimensions (HxWxD) in inches	OVP	Price
13802	SOLV15-5	5	3.0A	4-7/16x4x2	Fixed included	$39.95
13803	SOLV15-12	12	1.5A	4-7/16x4x2	Fixed included	39.95
13804	SOLV15-15	15	1.2A	4-7/16x4x2	Fixed included	39.95
13805	SOLV15-24	24	0.75A	4-7/16x4x2	Fixed included	39.95
13808	SOLV30-5	5	6.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13809	SOLV30-12	12	4.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13810	SOLV30-15	15	3.3A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13813	SOLV30-24	24	2.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95

13802-1 Data Sheet for SOLV Series 25

PIN FORMING TOOL



puts IC's on their true row to row spacing. One side is for .300 centers, Flip tool over for devices on .600 centers. Put device in tool and squeeze.

ONE TOOL DOES 8 Thru 40 PINS!
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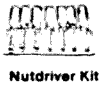
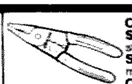


7 most popular sizes - 3/16", 7/32", 1/4", 9/32", 5/16", 11/32", 3/8"
Nutdriver Kit STOCK NO. 51001 **$21.95**



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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

wasn't much I could tell from them. They seemed to indicate that Read, operating under the name of Global Communications (thought that was RCA!), had a contract with Chile to run propagation tests using the ham bands from San Felix. The payment: $25,000. Not bad pay for making 700 ham contacts!

The Chileans are saying that he was never there. Well, having seen people get bum raps before, I kept my mind reasonably open and asked our people to try to reach Read. No luck. The phone numbers on the Global Communications letterhead were disconnected with no forwarding numbers. The phone company had no listing for the firm. The letter was mailed from Greece, with no address or phone number.

Then came a coincidence. I really enjoy it when something happens which would be laughed at in a fiction story because it is too pat. This time I was talking with a chap who runs a ham store and we were discussing some of the times when hams had paid him off with bad checks. He told me a most interesting story about a chap who had bought a hand transceiver and paid for it with a rubber check. It looked strange to him when the chap was unable to produce a driver's license, but he had a company letterhead for Global Communications. "Hold it!" I yelled.

I had him run over the story again after telling him about Bob Read and the CE0X story.

It seems that when the check bounced back from a closed account, they had tried two Global Communications phone numbers...disconnected. Then a couple years later, one of the salesmen in the store recognized Read when he came in. The word was quietly passed. Read wanted to buy a duplexer. This had to be ordered, so they took his order and promised shipment. Global Communications again. Instead of shipping a duplexer, they made up a box the right size and put a piece of wood in the top with the duplexer knobs glued down on it so it looked as if there were a duplexer in the box on casual inspection. They weighted the box so it would feel right, mounted the old bounced check inside, shipped it to Global, and awaited results.

A few weeks went by and then one morning there was a long-distance call from Saudi Arabia and a barely audible voice yelling, "You guys are going to be sorry!"

The next day a chap came in needing a duplexer immediately. Seems his friend was in Saudi Arabia and he had promised to deliver one there; he had to ship it over by air that day. He paid cash, you may be sure.

I looked up the call KF1O in the *Callbook*, but it isn't listed. The store owner involved had the idea that the chap wasn't really a ham but was just pretending to be. That might take some checking. His letter from Greece included a QSL card with the call.

Now, it may well be that there are some explanations for all of this. If so, I'm sure many of you join me in being curious about them. Just on the surface, from what I've heard and read, it sure is curious.

Notes keep coming in about good old Mr. Read. Either he has the worst press agent since Don Miller or else he is a bunch of bad news. I wish we could locate him to clarify reports of skipping bail on bad check charges, of unpaid-for Collins rigs, unpaid-for airline tickets, unpaid-for leased Mercedes, and things like that. Does anyone know where we can reach KF1O so we can get the straight story on all these mounting charges? Read must be one hell of a smooth talker if there is any truth to all these reports.

UNTOLD WEALTH

Well, it looks as if I've struck again. The TVRO material in *73* can, if you find yourself getting interested in it, lay the groundwork for getting into what is going to be a huge industry within a few years. I'm referring to the coming direct television broadcasting from satellites.

Sometimes I get discouraged. On the one hand I get letters from readers who thank me for getting them into new businesses such as home security, computers, and so on, telling me that I provided the impetus to get them going and that they've done well. Indeed, many have become wealthy. But then I still get letters saying that some poor reader can't afford a subscription. Now, with all that money out there just waiting to be grabbed, how can anyone be short of cash?

There are so many businesses that you can start at home, on your own time, with a very small investment, that one has to be awfully lazy to miss out. I suppose it is easier to make do with very little money and enjoy watching television rather than working one's butt off to start a home business. It *is* work, have no doubt about it.

There are still almost unlimited opportunities to sell security systems and service them. The computer field is still in its early stages of growth. I know someone setting up home sales of turnkey computer systems where it's possible to make about $2,000 profit on each sale...and *any* small business in the area is a good prospect for a sale. Now we're beginning to see the proliferation of software stores, something I predicted several years ago. Two outfits are already franchising them...and there will be more.

Once we start seeing direct television broadcasts from satellites, we are going to see billions of dollars in equipment sales and in service contracts. Knowing this, I assume that many readers of *73* will yawn, pick up a beer, and turn to the cable 24-hour-a-day sports channel. Well, the gold goes to those who go get it. The articles in *73* can, if you start paying attention to them, help to give you some of the experience you will need to cope with direct broadcasting.

SOMEONE NEEDS HELP!

Almost every part of our country is covered by at least one repeater, so when you think about it, we already have the backbone for a wonderful emergency alerting system. The communications medium is there, ready for use 24 hours a day, in good propagation or bad. We're just not using it with much efficiency.

Any of you who have spent many hours monitoring a repeater channel know why most of us do not do it. Talk about boring! With all due lack of respect, a conversation about where some mobiling ham is located at the moment may be fascinating to him, but not to anyone else. Long discussions about signal strengths fall kind of flat, too, particularly when the second station in the contact is only making the repeater a tenth of the time.

Then there are those never-ending tries at autopatching from a station just a bit out of range. Well, you know why *you* don't listen to the local repeater very often.

Before you get mad at me for putting two-meter ops down, let me explain that one of the reasons I'm not heard all that often on repeaters is that I've found that I fall into the same bad habits when I call in. I drive rather vigorously and thus have to put most of my concentration on my driving. The shreds of my brain left to handle my two-meter contacts are not enough to dredge up much in the way of interesting talk. I can talk or I can drive, but I can't do both with brilliance and neither can many other people, judging from what I've heard.

Okay, if we are going to monitor a repeater all the time so that we will hear the alerting call when it comes through, we are going to have to put in some sort of automatic alarm system. And if we are going to interest many hams in participating, it is going to have to be relatively inexpensive.

First, let me say that I'm wide open for any ideas for such a system. I'd love to have someone invent it and write it up for *73*. If you do, I'll try to find a manufacturer for it...with a royalty for you. Lacking that, perhaps one of the firms in the ham field will come up with a simple alerting system, in which case I'll still be interested in publishing articles on it and helping them sell the gear.

Thinking about what kind of system might fit the bill, I note

that many of us seem to spend the few bucks extra to put a touchtone pad on our HTs. TT decoder chips are not terribly expensive, so perhaps a little IC decoder can be made which will do the job. It could even be powered by the audio output of a rig and be flipped on with a certain set of tone signals.

If I were sitting in my lab building the project, I would design it to ignore any tone signals other than the wanted ones. Let's say that we decide on using the #2 and #3 keys, the "C" and "D" keys, if you will, since CD is not difficult to remember. Our decoder would ignore any tones not starting with a #2, thus keeping down the falsing. A system which gives false alerts is not going to be of much value.

That's just one idea...with the concept of keeping the whole system as simple as possible and yet relatively false-proof. If you have what you think is a better idea, why not put a unit together, test it out, and write an article on it?

I hope there is no argument about the need for a universal alerting system. Not only is this needed for local emergencies, but for national drills. There *should* be some way of getting in touch with *every* member of a repeater group, night or day, at home or at work.

S-9 GONE, TOO

Cowan Publishing, which for years published *CQ Magazine* and *S-9*, recently turned *S-9* over to another magazine to fulfill the circulation responsibilities. That's about the end of Cowan, I think.

CQ, which was in its heyday in the late 50s, was owned by a non-ham and run as a family business. It was losing money in January, 1955, when I came on as editor. Within a few months, by changing the magazine from a column-oriented publication to an aggressive magazine for builders, I got it into the black. Indeed, by 1959 I had it going so well that it made over $100,000 in profits, which was a good deal of money for those days. Publishing *can* be very profitable.

After several battles over trying to get them to pay my authors for articles, I was finally fired in January, 1960. I had checked the books and found them to be as much as a year and a half behind on paying authors, with few paid within a year of publication. I ended up having to pay for material out of my own pocket (for which I was never reimbursed, despite promises...a loss of about $10,000 ...which also was a lot of money back then) in order to keep the magazine going.

That's when I started *73* and aimed it at doing what I had wanted to do with *CQ*...get hams interested in building. *CQ* went back to monthly columns, with little in the way of articles and circulation gradually dwindled down. Insiders told me that their circulation had dropped well below 10,000. Every now and then Cowan would write an editorial saying that he had neglected *CQ*, but that all that was changed and it would be made better. Nothing happened. Eventually he got tired of the losses and "sold" it to his editors.

S-9 went the same route, essentially. It just gradually faded away of neglect. Funny thing, for when CB was riding high, I was under a great deal of pressure from my advertising sales manager to start a CB magazine. I didn't believe that CB would continue its popularity, so I held back. Good move.

S-9 was absorbed by *CB Magazine*. Oh, it has a recent new name, but I forget what it is. It's improved of late due to the entry of Gordon West. It's now a sort of combination CB, SWL, pre-Novice magazine.

I think we learn more from the screwings we get than from our successes. I know that I sure learned how *not* to run a magazine from Cowan...and perhaps that was worth the year's pay he still owes me.

REVIEW

THE ICOM IC-730 HF TRANSCEIVER

The Icom IC-730 HF transceiver is the product of an engineering philosophy dedicated to offering as much radio in as small a package at as low a price as is feasible. Icom currently offers two HF transceivers (the other is the IC-720A), but the design concepts behind the IC-730 more closely resemble the no-longer-available IC-701 than they do the IC-720A. Because of this, we'll be comparing the IC-730 primarily to the IC-701.

Sitting flat on a table, the IC-730 measures just over 4 inches tall, 9½ inches wide, and 10¾ inches deep, making it considerably smaller than either the IC-701 or the IC-720A. In addition to its unique features, it offers the usual amenities we have come to take for granted in an HF transceiver: RIT, rf gain control, digital readout, speech processor, VOX, fast/slow agc, noise blanker (with two widths), i-f shift, and a full 100 Watts output (minimum) from the same finals that were used in the IC-701. No tune-up peaking or tweaking is necessary in either transmit or receive mode. On the bandswitch, AM is present along with SSB, CW, and a narrow CW position. The front panel is well laid out, a factor of great importance to both the dedicated DX-hound and the mobile operator.

Special Features

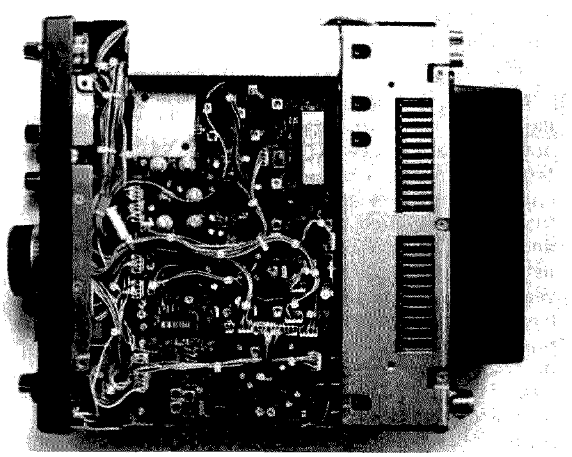
Like the IC-701, the 730 sports fully synthesized tuning. Three interlocking push-button switches to the right of the main tuning knob select the tuning rate, which can be In 1-kHz, 100-Hz, or even 10-Hz steps. While some prefer continuous tuning, we feel that the many advantages of step tuning far outweigh any of the supposed disadvantages. The 10-Hz-per-step tuning makes for a positively luxurious bandspread—one complete revolution of the tuning knob changes frequency by only 1 kHz! When speed is of the essence, selecting the 1-kHz-per-step rate will allow you to get from the low end of the CW band to the high end of phone in two seconds flat.

Just beneath the tuning rate switches is the LOCK switch which electronically locks the 730 on the displayed frequency. Engage it and the main tuning knob is disabled. If you've ever bumped the vfo knob just as a rare DX station returns your call, you'll appreciate this feature! The RIT control operates even when the LOCK is on.

Icom transceivers are famous for their dual vfo's, so there are no surprises here. The IC-730 has two vfo's controlled by a four-bit microprocessor. They can be used separately as memories, keeping track of activity on two different frequencies, or they can be used together for split RX/TX operation. When you consider how much you normally pay for an external vfo, you begin to realize how much of a bargain the IC-730 really is!

There is also a separate memory for each band which can be programmed independently of either vfo. We've used virtually every HF rig which incorporates memory functions, and the IC-730 is the first unit we've seen

Front view of the IC-730.



Top view of the IC-730. Note liberal use of wiring harnesses and plug-in connectors.

which forced us to get out the manual to help figure out memory function. Fortunately, once you read through the examples, all becomes clear. Perhaps rewording the front-panel labels would speed comprehension! If you often operate on specific frequencies, you'll appreciate the memory backup feature. As long as there is 12 V at the memory backup connection, the memories are not lost when power is shut off.

As is becoming common these days, metering is sparse. The IC-701 allowed you to view S-units, ALC, compression, collector current, voltage, and rf output. With the IC-730, you'll have to make do with ALC and rf output.

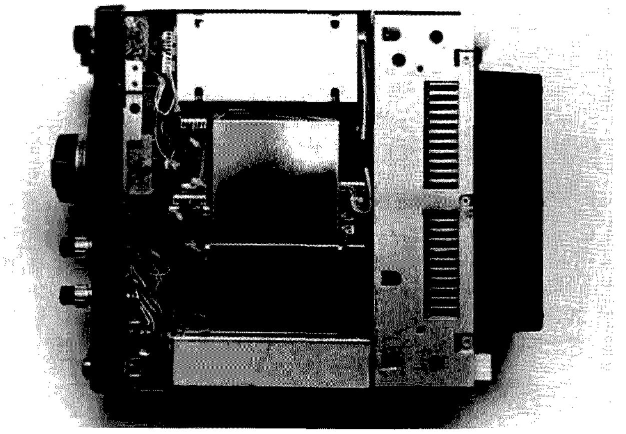
An extremely welcome innovation is the built-in preamp. While this may appear to be a gimmick, anyone who has used a good preamp can attest to its usefulness. The preamp is located between the low-pass filters and bandpass filters, and, when switched in, exhibits about 12 dB of gain.

The IC-730 covers all ham bands between 80 and 10 meters, with generous amounts of coverage above and below each band. Our sample tuned everything between 3.4 and 4.01 MHz, 6.9 and 7.6 MHz, 9.9 and 10.6 MHz, 13.9 and 14.6 MHz, 17.9 and 18.6 MHz, 20.9 and 21.6 MHz, 24.4 and 25.1 MHz, and 27.9 and 30.1 MHz. The 10-meter band has four separate sections on the bandswitch.

The microphone connector is an eight-pin affair with pins to allow up and down scanning with a push-button microphone. Much to our surprise, the wiring diagram in the manual includes only the pinouts for PTT and audio. Icom apparently feels that hams cannot be trusted to wire their own scanning microphones! The scanning capabilities are convenient for hams who wish to remote-control the rig for some reason, and it's a shame that Icom didn't come right out and tell us which pin does what. If you intend to use these pins, make sure you know exactly what's what. Short the wrong pins and you'll watch blue smoke curling into the air!

Several controls are hidden away beneath a small port on top of the rig. Theoretically, these are controls which seldom need adjustment. There are pots for sidetone audio level, anti-VOX, VOX gain, VOX delay, frequency calibration, and swr set. There are miniature slide switches for noise blanker wide/narrow, speech processor on/off, and swr forward/reflected. Icom's judgment was sound on all but the speech processor. We'd really prefer to have that switch located on the front panel, particularly since the access port will be completely inaccessible in most mobile installations. On the bright side, Icom's speech processor is exceptionally clean and distortion-free. If properly adjusted, there is no reason why it can't be left on all the time.

On the left side of the rear panel are the power socket, *ground connection, and* antenna connector. The middle area is occupied by the heat sink and fan for the final amplifier. On the right side is a jack that can be wired for either memory backup or amplifier relay switching. There are also jacks for ALC input, speaker output, CW key, and a multi-pin accessory socket with all the necessary signals available for transverters, phone patches, and bandswitching for the IC-2KL linear amplifier. There is no direct access to the microprocessor as there was with the IC-701.



Bottom view of the IC-730. Note the extensive internal shielding.

Inside the IC-730

The layout inside is light-years ahead of its predecessor. There is liberal use of small boards interconnected with plugs and jacks, making servicing easier on everybody. A great deal of internal shielding is employed, which probably accounts in part for its immunity to RFI from microcomputers.

The instruction manual is reasonably good, although it is obviously targetted at the appliance operator. Some Japanese manufacturers (like Yaesu) are including more and better service information with each new rig they introduce. Icom seems to have taken a step backward, for the manual supplied with the IC-730 is not as complete as the one we received with our IC-701! The IC-701 was supplied with charts of voltage readings at critical locations and more or less complete sections on theory of operation and alignment. No alignment instructions are furnished with the IC-730, and the circuit description is not particularly informative since no mention is made of specific components. Fortunately, there is a large fold-out schematic, and an even larger board layout diagram. Emergency repairs could probably be made from this information, but hams planning to take on their own maintenance and repairs by choice or necessity would do well to pester Icom America for more complete service data.

The Power Supply

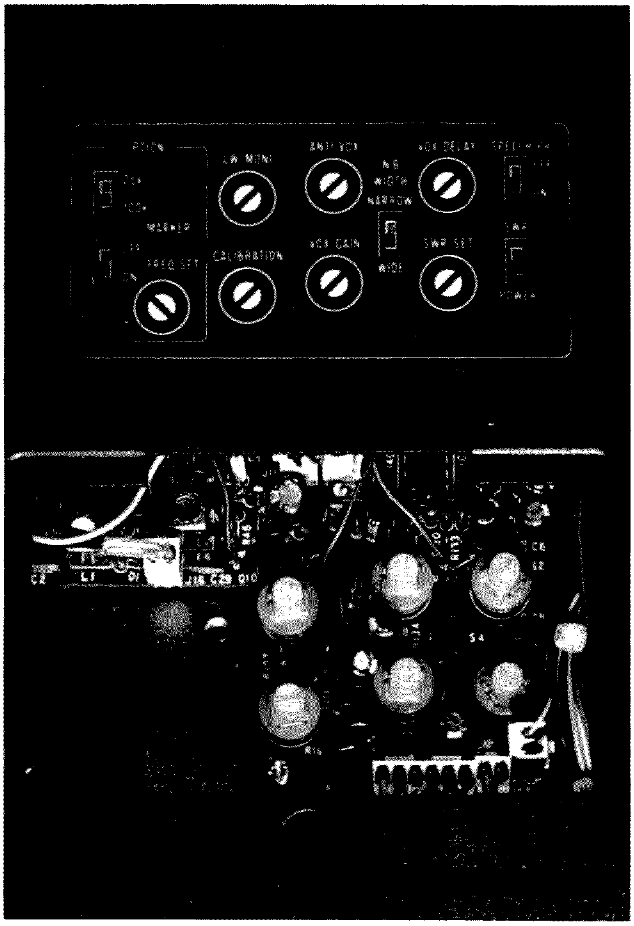
Our review sample was supplied with the IC-PS15 power supply, rated at 12 V dc and 20 A, with a 10-minutes-on, 10-minutes-off 50% duty cycle. It is well regulated and probably adequate for casual operators, but contesters and serious CW operators might do well to look into a heftier supply. As is the case with many 12-volt power supplies from transceiver manufacturers, the PS15 is designed to work only with the rig it matches, so it can't be used with other station equipment. Moreover, it only superficially matches the rig in appearance and lacks the traditional front-firing speaker. Considering the price tag, a hefty well-regulated 20- or 30-Amp supply from a reputable power supply manufacturer might be a better choice.

Accessories

The IC-730 is supplied with a preamplified hand microphone, a bag of plugs, and a hefty dc power-supply cable. Accessories available at extra cost are a marker unit with output every 25 or 100 kHz, a 500-Hz CW filter, a CW audio filter, full passband tuning, base station microphone, scanning hand-held microphone, mobile mounting bracket, external speaker, phone patch, and power supply.

On the Air

From the moment you turn it on, it's obvious that the IC-730 is a top-notch rig. We were a little



Access port on top of unit. Blank space in bottom left corner is for optional marker unit.

concerned about the quad-conversion design and birdies, but the 730 uses up-conversion with i-f's at 39.7315 MHz, 9.0115 MHz, and 455 kHz, reducing these problems to a minimum. Careful listening without an antenna turned up a couple of weak birdies inside the ham bands, but they didn't even move the S-meter. Outside the ham bands, we found only a few louder signals, ranging from S-3 to S-5. Not bad!

RTTY operators should note that the IC-730 is very well protected against RFI from microcomputers. With an antenna located some distance away, we placed the 730 three inches away from a disk-equipped TRS-80 Model III and heard no RFI at all. Most other rigs we've tested suffer varying levels of interference under these conditions.

Received audio quality is excellent, and there's lots of it. We used the IC-730 in a noisy car for several weeks without any external speaker, and it was fine. There seems to be more high-frequency audio available than there was in the IC-701, which makes speech easier to understand. As with every other rig we've tested, lots of internally-generated hiss and noise can be heard, even when no antenna is connected. Transmit audio was excellent, with most other hams reporting that audio quality was best with the speech processor in the "on" position. On the negative side of the ledger, the cooling fan runs continuously in the transmit mode, and also in the receive mode if the rig is overheated. We found noise from the fan slightly annoying in a quiet room, although it is much quieter than the fans in high-power amplifiers.

As for general receiver performance, the IC-730 seems to be more sensitive than the IC-701, and audio quality is substantially improved. Dynamic range was quite good, too. Serious CW operators will probably not be happy until they install a CW filter, however.

We really don't enjoy torturing equipment, but we felt obligated to run a few tests in the interest of science. With the rig in the transmit mode at full output, we flicked off the power switch and turned it back on again a few seconds later. Another solid-state transceiver we were considering for review blew an internal soldered-in fuse when subjected to this treatment. It took an hour to find and replace! The IC-730 (and the PS15) showed better manners and never missed a beat. While some might consider this test unreasonable, it is vital that a rig be able to pass it if it is expected to operate under emergency conditions.

To test the swr protection circuitry, we transmitted into a variety of less-than-perfect loads. We also tried a couple minutes of transmission with no load at all. No problems developed. We performed similar tests on our IC-701 when we first received it, and after three years of hard use, often under less than optimal conditions, the original finals are just fine, thank you! While there is undoubtedly a particular combination of load, rig, and idiot that will blow the finals, all indications are that the IC-730's final amplifier will be highly reliable.

Hams who find an attenuator indispensable should be aware that there is none on the IC-730. In all fairness, we must say that while we have encountered many operators who have professed great regard for these devices, we have never seen them actually use one on a modern rig!

Conclusions

Several months of use have left us with nothing but respect for Icom's compact HF transceiver. Indeed, returning it leaves us with a feeling of great loss! The only thing we'd like to see added is a good notch filter and perhaps a RTTY input for direct FSK. Practically speaking, though, neither of these are available on other compact transceivers.

For our style of operation, the IC-730 is one of the best transceivers we have yet encountered, regardless of size or price. Most intriguing of all, it appears as though the little IC-730 might stand up well to the rigors of DXpeditioning. If you are looking for a small transceiver but are unwilling to compromise on performance or give up features, the IC-730 deserves serious consideration. For more information, contact *Icom, 2112 116th Ave. N.E., Bellevue WA 98004.*

Paul Grupp KA1LR
Casselberry FL

LICENSE PLATE HOLDER

If you happen to live in one of those states where only a single license plate is required and you're a radio amateur to boot, Vani-Plate has something that you'll be interested in: a vanity plate holder *and* the plate to go with it!

You can dress up that bare front bumper with a personalized vanity plate showing your raised callsign in white or black on a variety of colored backgrounds, framed in a chrome bracket which sets it off attractively on your vehicle.

The mounting plate is made of Plexiglas® and is available in background colors of blue, white, black, red, or brown. Alternatively, you may choose the "fleck" background with a

The Vani-Plate.

Spider antenna from Multiband.

"pearl" appearance in red, green, gold, blue, or silver.

The standard plate costs $9.95; the fleck background is an additional $3.00. A heavy chrome frame is $2.99, while a deluxe chrome frame is $7.99. UPS charge is $1.95.

For additional information (catalog: 25¢), contact *Vani-Plate Company, PO Box 136, West Yarmouth MA 02673.* Reader Service number 481.

Jim Gray W1XU
***73 Magazine* Staff**

MULTIBAND ANTENNAS

The first time I saw the Spider antenna, I was intrigued with the unusual design and wondered why anyone would put something like that on a car. The location was San Diego, and the event was the ARRL Southwestern Division Convention and "Hamputer" fest.

Fred Schmitka of Multiband Antennas had a booth there, and he had several of these mobile antennas conveniently mounted at the booth which caused a lot of gawking and a lot of stopping to question Fred all about the whys and wherefores. I was one of the stoppers and gawkers, too, and learned that Fred and his brother Len have spent several years perfecting—and patenting—the Spider.

Basically, the Spider is a mobile antenna that permits operation on 10, 15, 20, and 40 meters from your car. The antenna consists of an aluminum (or stainless steel, if you prefer) mast section about four feet high, with four "fingers" protruding from the top at various angles. The 40-meter finger sticks straight up, more or less as a continuation of the mast, while the 10-, 15-, and 20-meter fingers are arranged radially around the mast at about 120-degree spacing, like the spokes of a wheel. Each finger also tilts about 45 degrees from the vertical. These fingers are the resonating elements for the four bands and consist of fiberglass rods or tubes helically wound with wire and covered with a tough, transparent plastic. An index scale is molded into each element so that adjustment to exact frequency can be made. This adjustment is provided by sliding a short tubular section along the resonator element until minimum reflected power is measured at the feedpoint of the antenna.

The big advantage of the four separate resonating elements is the fact that the antenna is fully and automatically bandswitchable without the driver ever leaving his seat. You merely pre-adjust each resonator to your favorite frequency within the band, and that's it. . . or so Fred assured me. He also suggested that the mobileer not use a base spring to mount the antenna on the car, but instead use a solid mount to keep the antenna vertical, even at highway speeds.

Well, I was fascinated by the idea, and Fred kept assuring me that the antenna worked as billed and that the helical resonating elements placed at the top of the antenna provided the highest possible position for maximum current (i.e., top loading, exactly where you want the current maximum in a mobile installation). To make a long story short, I had one shipped to *73* HQ for a test. I also asked Fred to include a bumper mount for my 1980 Olds Omega and a quick-disconnect fitting to prevent unwanted and undesirable removal by my garage door or other low overheads. Of course, Fred didn't have anything that would remind me to remove the antenna before driving in, so that part is up to me. At least I'd be all set to quickly remove the Spider should I remember in time.

The afternoon of the Fourth of July was spent installing the antenna on the car. I made a secure bumper mount, assembled the antenna according to the instructions, and with great trepidation fired up the rig. What's this? Signals coming in at S-9 on 40 meters in mid-afternoon? Hmmm. . . let's try 20. Yep, signals there, too; and on 15, and 10, too.

I connected my swr bridge into the line at the base of the antenna and put a very small amount of rf into the antenna starting with the 20-meter band and my favorite frequency there. A couple of slides of the slider tube and the meter showed zero reflected power. Wondering about possible interaction, I tuned up to 40 in the same way, and then 15, and then finally 10. Fully expecting to have to go back and readjust each one because of interaction, I was amazed to find that the original settings still held and that no retuning was needed.

Now for the proof test. . . the so-called moment of truth. I heard W2JAU in New York calling CQ on 40, so I gave him a quick reply. He came back and said that I was 5-8 in Brooklyn! "Pretty good signal for a mobile," Ben said. "What are you using?" Well, have you ever tried to describe something like a Spider over the air? No? Well, you've got a treat coming. After a nice long, solid QSO with Ben, I decided to try 15. I answered EC4AQS in Spain and OE8LKK in Austria. The Spanish station was very QSB, but we did have a good QSO. The Austrian station was loud, and that QSO was much better. . . but still the band was not in very good shape. Nevertheless, we managed to work out quite well, considering that my driveway is not the best DX QTH in the world. Back to 40 meters, I contacted Bill VE3BDO in Ottawa who was using his recently acquired GFT-ONE. We gave each other 5-8 to 5-9 reports and talked a bit about our new toys.

The rig I used was a venerable TS-520S which didn't even know it was in the car. . . since it loaded just as well as it ever does on the fixed-station antennas. Now to try the bandwidth and how far I could go without exceeding a 2:1 swr.

On 40, I could move close to 50 kHz without exceeding 2:1 vswr. On 15, it was better than 100 kHz, as it was on 10. What about 20, you ask? Well, to be honest, I hadn't tried 20 by the end of the first afternoon; that had to wait for July 5th—another holiday—and results were equivalent to those on the other bands. My first answer brought W8TA in Detroit (short skip QSO) and a 5-7 report. Bill's signal was also about 5-7 to 5-8, and we had a good chat. Bandwidth without retuning the resonators was about 75 kHz. Here it should be mentioned that each resonator is wound long purposely so that resonance can be obtained below the bottom band edge. (This is a feature which appeals to MARS operators. If it is desired to achieve resonance at the top edge of the band, it may

be necessary to remove some turns of the coil.[1])

I should mention that I also chatted with Chuck W2WGL in Utica, New York, on SSB. He gave me a good 5-7 report on 40-meter phone and remarked at the steady signal. Well, it ought to have been... I was parked!

Unfortunately, 10 was not open, so I haven't been able to make any QSOs... but I'll keep trying! With a good band opening, there ought to be plenty of stations willing and able to work W1XU mobile.

One more thing I ought to mention about the Spider antennas... or maybe a couple more things: First, the fact that if you already have a base rod from a Hustler, for example, you can get an adapter from Fred to adapt your base rod to his Spider. It's the economical thing to do and works just great. You can use either antenna whenever you wish... just by changing from one top, or resonating, section to the other. The second thing I want to mention is that the Spider antennas might very well be excellent for use in mobile homes, RVs, apartments, or what have you, where a limited-space antenna is mandatory. One precaution, though: Be sure to use an adequate ground plane... like the chassis of your car. When you don't have such a ground plane, use radials, a railing, a counterpoise, or whatever you can find that will serve the same purpose. One trick passed on to me long ago by a ham whose name I've long since forgotten is to use a piece of four-conductor rotor cable as your ground plane or counterpoise. Just cut each of the conductors, one per band, to the quarter-wavelength-plus-2½% formula. They really work and provide the much-needed "phantom" antenna. This can be a big help in apartments and condos.

Maybe if the super asks what that funny thing is that is attached to your balcony railing, you can say that it is a clothes-tree. Most of us, however, will find the Spider in use on our vehicles, whatever they may be. Travel trailers are excellent for the Spider, too.

Perhaps the best thing about the antenna is that it can be tuned to your favorite part of the band and forgotten unless you want to really change to another part of the band entirely, in which case you merely adjust the slider. An afternoon of doing a frequency plot vs. index markings on the resonators will arm you with the data you need for almost instant band changing. The reason that Fred and Len don't provide frequency vs. index marking information is because each installation will be different, and what's sauce for the goose ain't necessarily so for the gander. Thus, you'll have to go through the tuning and pruning operation once when you first install the antenna. After that, it's all downhill. Besides, you want to do *something*, don't you?

Finally, I have to say that the workmanship is solid, functional, and efficient. As for beautiful, all I can say is what my grandmother used to say: "Pretty is as pretty does." The Spider is therefore beautiful by definition, because it does pretty well indeed. Don't take my word for it, try one yourself... you'll be glad you did.

For more information, contact *Multiband Antennas, 7131 Owensmouth Ave., Canoga Park CA 91303*. Reader Service number 476.

Jim Gray W1XU
***73 Magazine* Staff**

[1] In my tests I noticed that on 40 meters with the tuning ring slipped all the way to the bottom of the resonator, I could just achieve unity swr at about 7150 kHz. Yet, with the ring only halfway up the resonator, I was able to achieve unity swr at 7.005 kHz. This means to me that there is a lot of room for pruning the resonators so that adjustment of the sliding ring will achieve unity swr at both band edges. To prune, just slip off the plastic cap and carefully peel turns loose. After removing turns, carefully cut the wire and throw the excess away. Tuck the remaining end back into the resonator and recap it.

CUSHCRAFT R-3 HALF-WAVE VERTICAL

We all remember the old cliches about vertical antennas, but the problem is that most of them weren't true. I've used vertical antennas with good success over the years and have owned most of the brands on the market at one time or another.

Oh sure, if you insisted on ground mounting your vertical, refused to place it in the clear, and just drove any old kind of ground rod into the soil instead of furnishing decent radials, you were disappointed... and have only yourself to blame. On the other hand, if you placed that vertical at a decent height, provided a set of radials at the base, and took pains to tune and prune it properly, you had a fine antenna that worked its share of DX.

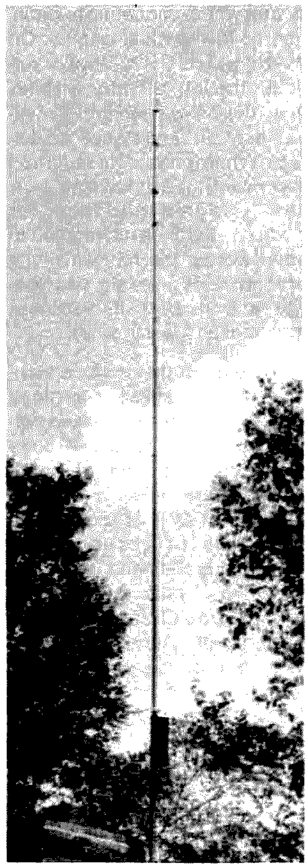
Cushcraft has long been known for its fine line of HF and VHF beam antennas, and there are few of us, indeed, who have not seen or heard them play on the various ham bands. Perhaps fewer of us have seen or used their multiband trapped quarter-wave vertical antennas, and I'm sure that fewer still have really paid sufficient attention to what Cushcraft has accomplished with their new R-3. Believe me, it's a breakthrough!

Let's go back for a minute or two and review what we know about vertical antenna patterns... particularly the best-known and most popular vertical, the quarter-wave ground-plane vertical... to establish a basis for discussion of the R-3.

Most hams turn to verticals as space-saving antennas when they don't have room to erect larger arrays such as horizontal dipoles, beams, extended wire antennas of all kinds, and others that require reasonable (sometimes unreasonable) amounts of real estate to own and operate.

Those who have used verticals with success, including those forced to use them because of space limitations, have discovered that quarter-wave verticals seem to work very well at close distances and very well at long distances. However, at mid-range distances, verticals often don't seem to work as well as conventional horizontal antennas. The reason for this seeming anomaly is the angle of radiation, specifically the vertical angle of radiation.

In order for the normal dipoles and other horizontal antennas to exhibit their best vertical radiation angles, they must be placed at least one half wavelength above the ground surface. The vertical antenna, in contrast, exhibits a very low vertical radiation angle even though its bottom end is resting on the ground. Each amateur band has a different optimum vertical angle of radiation for maximum distance transmission. For example, an optimum vertical angle of radiation for a horizontal antenna on the 20-meter band would be about 10-15 degrees for the best DX. By the time the vertical angle of radiation is as high as 20 or 30



The R-3 half-wave vertical from Cushcraft.

degrees above the horizontal, it has become a mid-range antenna and rather poor for DX. As the frequency becomes higher, the required vertical angle of radiation for best DX performance becomes lower, while the converse is also true.

Thus, for best performance as a DX antenna, a horizontal antenna must not only be physically large and take up considerable space, it must also be high... as most DXers know, the higher the better. On the other hand, vertical antennas with their naturally lower vertical angles of radiation tend to be natural DX antennas. (Be patient, readers, we're almost there.)

VHF mobile operators have found that quarter-wave ground-plane verticals, while adequate for working close-in stations on VHF, suffer when trying to really reach out, because a large portion of the radiated rf is still radiated at angles too high for line-of-sight work. The solution to this problem is the use of gain antennas, antennas which are longer than a quarter wavelength at the operating frequen-

cy and which concentrate radiation at low vertical angles. On the HF bands the half-wave vertical, though slightly shorter than the 5/8-wavelength antenna, has an additional advantage: While most of its radiation is concentrated at low angles, it has a high-angle lobe for medium distance coverage. In other words, the half-wave vertical provides good signal coverage at virtually all distances from close in to far away.

There is another major advantage of the half-wave vertical. Unlike its relatives, the quarter- and 5/8-wave verticals, it does not need a ground plane or ground-plane radials to function at its best! One of the biggest bugaboos of ground-plane antennas is the need to provide a system of radials or a nearly perfect ground for the return current path. Although the vertical part of the quarter-wave antenna is, in fact, a space saver, the radials required tend to offset much of this advantage. Those of you who have wives, mothers, or neighbors who take pride in their homes and in the appearance of the property (as do most hams, of course...ahem) know that radials in the form of wires strung around to the roof edges, adjacent trees, stakes in the ground, etc., are unsightly and inclined to arouse the worst in human nature.

Enter the R-3. Here is a vertical antenna *without radials of any kind* that covers the three most-used DX bands: 10, 15, and 20 meters. The R-3 is a true electrical half-wave vertical radiator on each of these bands. It has two traps which effectively shorten the antenna physically yet permit resonance on each of the bands. Best of all, the R-3 can be tuned to exact resonance at your desired frequency within each of the bands... remotely, right from the shack!

Inasmuch as Peterborough is only a forty-five-minute drive from Manchester, site of the ultra modern Cushcraft manufacturing facility, Bob Cushman and Glenn Whitehouse graciously invited me to pick up the R-3 myself and take a plant tour. After a pleasant and very informative walk around the plant, which included a peek at the antenna test range, the laboratory, and the production lines, I picked up the packaged R-3 in its box, tucked it into my car, and took it home.

Several major groups of components make up the R-3, each in its own container, well protected from damage and almost immune to everything but an intentional effort to destroy. You will find the CTA capacitor/motor unit in its own box, the indicator/control unit in another box, the traps and aluminum parts in the main box, and all of the hardware in a plastic bag... and I mean *tough* plastic. A complete set of illustrated instructions, with exploded assembly views and parts list with picture identifiers, completes the package.

All you need to assemble the antenna is a screwdriver, a small adjustable wrench and/or a pair of pliers, and a tape measure. The base section is assembled first by making up the matching and feed ring and attaching it to the base. Next comes the capacitor box with its internal motor, and finally the traps and aluminum tubing which, when assembled properly, becomes the R-3... all 22 feet of it. I was impressed with the quality of the aluminum, the stainless-steel hardware, the *correct* number and sizes of nuts, bolts, and washers, and the general attention to detail that characterizes this antenna. The instructions are clear and straightforward.

Having learned my lesson long ago to read the intructions first, I spent some time looking at the drawings, reading the assembly steps, and comparing hardware to the lists of same.

Wherever a dimension was given, I followed it meticulously, measuring everything carefully to see that it was correct. With the assembly drawings and exploded views, I am convinced that anyone could assemble the R-3. The entire process of making up the antenna took me exactly one hour and thirty minutes... ready for installation.

I had a chimney mount that used to support my small beam, so I decided to use that... together with a five-foot piece of TV mast tubing to which the R-3 base is bolted. If you prefer to mount your R-3 on some other kind of support, it will fit over any kind of pipe or mast up to a 2-inch diameter. I also had a suitable length of four-conductor rotor control cable salvaged from the former beam installation, so I decided to use that for the control box and remote motor hookup. Please note that when you buy your R-3 antenna at your dealer or when you order it by mail, also be sure to order enough four-conductor cable to reach from the point of installation to your operating desk where the control box is likely to be located.

At this point, I was ready to attach the coax to the antenna, so I chose the right length of RG-58/U (since I run only 200 Watts and don't anticipate using an amplifier) with a PL-259 connector on the end. Cushcraft provides a neat little neoprene sleeve that fits over the coax fitting and also gives you a tube of silicone grease to waterproof the coax connection at the CTA box. I would also recommend that you tape and waterproof the control cable connection at the connector block... just to be safe.

A quick once-over and I was ready to apply power. The control box did move the indicator needle back and forth across the dial... from below the 20-meter band markings to above the 10-meter band markings, so apparently the capacitor was moving correctly in its box. I returned it to the 20-meter position and decided to try that band first.

My swr meter was connected in the circuit, so I applied rf power to the antenna at the low end of 20 meters while I moved the switch to resonate the antenna, i.e., tune it to frequency. Suddenly, the swr began dropping, and dropping... and dropping. It fell *below* 1.1:1! Then, just as quickly, it began rising again, so I knew that I had passed the point of resonance. Unable to resist temptation, I switched back to the point of lowest reflected power, made a quick call, and raised K4OAH. "Five, nine, nine here in Atlanta, OM," came the report. After a brief chat, I moved on, working several US and foreign stations in quick succession, receiving *very* gratifying reports.

The 15-meter band didn't seem to be so hot, but I tried anyway, figuring that even if I didn't raise anyone, I could at least check out the tuning range of my R-3. Again, with actuation of the switch on the control box, I watched the swr drop further and further... and, again, it stopped below 1.1:1! What the hay, as long as I was tuned up on 15, why not call into a dead band? It couldn't hurt. Believe It or not, K4CG answered me and gave a 589 report in Alexandria, Virginia.

The R-3 was beginning to make a believer out of me.

On 10 meters, which *was* closed, I did manage to tune up as before, with the same results... and an swr below 1.5:1 at resonance. You ought to know that the instructions are very explicit about tuning, and they mention that if the antenna can't be resonated to less than 1.5:1 at the upper and lower ends of each band by merely tuning the capacitor through the control box, then you will have to change the length of the antenna slightly... all of which is carefully explained.

I figure that mine worked at the specified dimensions with no changes from the nominal ones given in the instructions because it was mounted high and in the clear, without the length-changing influences of nearby trees, wires, and ground.

To date, I have had an opportunity to use the R-3 antenna on both phone and CW in various parts of the bands and have found it unquestionably superior to my regular quarter-wave trapped vertical in terms of the signal reports that it delivers and especially in hearing signals. Being tunable to exact resonance, it tends to filter out unwanted portions of the band by exhibiting a high Q factor. I have particularly noticed its ability to hear mid-distance stations as well as DX at the same time and to work equally well on short skip and long-haul communication.

Not having a beam, but having various horizontal and vertical antennas for comparison, I can truthfully say that my R-3 outperforms them all in both received and sent signal reports. As the old saw goes, "You can't work 'em if you can't hear 'em," so the rest is up to me. No more excuses for not getting the rare ones. By the way, that brings up an interesting point: I worked VE1SPI on St. Paul with the R-3 antenna, on 15 and 20. Better still, I got them on the *first* call... in itself a relatively rare experience for me.

Is there anything that I didn't like? To be honest, no, there is not. You have to be careful in hooking up the remote control

cable, and be sure you correctly identify which pin Is which, because it will not work if you don't. Also, you have to be careful in putting up an all-metal antenna of *any* kind to prevent contact with power lines and the like. I would also highly recommend that you connect a surge protector in your coax line to bleed off accumulated static charge and minimize the possibility of a lightning strike.

To sum it up, then, I have to say that the Cushcraft R-3 packs a powerful punch in its slim and trim length, and I recommend it highly to anyone who needs a good antenna that can be erected almost anywhere *without* radials and turn in unsurpassed performance for a vertical.

For more information, contact *Cushcraft Corporation, 48 Perimeter Road, Manchester NH 03108.* Reader Service number 480.

Jim Gray W1XU
***73 Magazine* Staff**

KTI-20 POWER SUPPLY

A power supply isn't a glamor item. If it does what it should do, supply a regulated voltage at its rated current, you should be able to ignore it and concentrate on the device that is being powered. The Kem-Tron Industries KTI-20 power supply isn't glamorous and it can be ignored once safely installed in the shack.

The KTI-20 is a 13.8-volt, 20-Amp regulated supply. Its 20-Amp rating means that it isn't quite big enough to power a 200-Watt solid-state HF rig, but it will do very nicely as a supply for just about any less-current-hungry rig in your shack. The supply uses an LM723 regulator driving four pass transistors and contains a crowbar protection circuit that will shut down the supply if a regulator failure should cause the output voltage to rise above a safe level. The output voltage is variable plus or minus about ten percent around the nominal 13.8 volts.

I've used the KTI-20 in my shack for some time to power my 2m rig and, occasionally, a 160-Watt 2m amplifier. It has been left running continuously for days on end with no ill effects.The KTI-20 will drive my Mirage B3016 amplifier, but won't drive both the amp and exciter at once. That's not the supply's fault, since the two together draw almost 27 Amps.

It's a shame that this supply wasn't designed 5 or 10 Amps heavier. The 20-Amp rating is too large and too expensive to drive a low-power 2m rig and too small to drive a solid-state HF rig. But if your total power requirements at 13.8 volts can be met by a 20-Amp supply, the KTI-20 is a good choice at a price that's also a compromise between large and small supplies—$129.99.

For more information, contact *Kem-Tron Industries, 1424 E. Indianoia Ave., Youngstown OH 44502.* Reader Service number 479.

John Ackermann AG9V
Green Bay WI

CR2A ANTENNA FROM COM-RAD INDUSTRIES

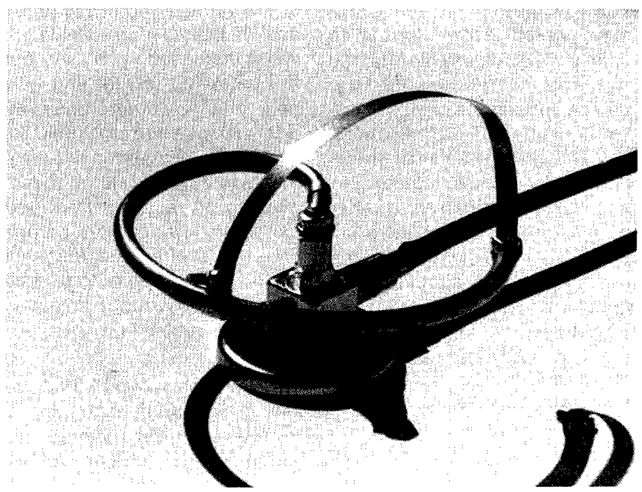
Your first impression will be "What is it?" The second may be "How does it work?" or "Hey, that's sure different—I wonder what it's for?" My neighbors thought I had left a fancy dish on the top of the car, and my wife remarked that it looked like a flying saucer (whatever *they* look like).

To me, it looks like a directional discontinuity ring radiator, or DDRR... which is exactly what it is. Okay, I guess I do owe you an explanation about the mystery, so let's take first things first.

A few months ago Jim Waldron of Com-Rad Industries (which means Compact Radiating) called me on the telephone and asked me a few questions about advertising. It seems that Jim has been playing around with antennas for years and has been particularly interested in space-saving antennas, aerials that will permit hams to operate from apartments, condominiums, mobile homes, offices, and the like.

This is all well and good when we are talking two meters and higher frequencies, but what about the HF bands? Aye, that's the rub... what *about* them? How can you operate from an apartment or condo when the landlord or the management (or your neighbors for that matter) objects to any outside antennas. What do you do if you're a DXer and an avid rag-chewer, let's say on 20 and 80 meters, respectively.

Well, Jim had thought a lot about these problems and, being a man who has done extensive travelling and his share of operating from the car, from motel rooms, and from other sites, knew about the problems. The one thing he didn't do was give up; he researched various shapes and arrangements of radiators in a variety of combinations and finally developed a combination of radiator, inductor, and capacitance that would allow him to operate on any band from ten through 80 meters with good results. Checking into the several nets he uses, he asked for reports on his signal. He asked DX stations how they copied him, and he rag-chewed with many hams all over the country... all on the space-saving designs he developed. They were successful, and he knew that others would like them or more likely *need* them.


Com-Rad's DDRR antenna.

The question he asked me was "How do I get the message across?" and my answer was advertise first in a New Products release, and second in a display ad. So we introduced the first and smallest of the Com-Rad antennas in our May, 1982, New Products section... the DDRR model CR2A.

In his travels, Jim had discovered that two meters is almost indispensable for mobile communications. However, there are problems associated with whip antennas in general, and we have all faced these from time to time in varying degrees of severity. Example: I nearly had the entire whip, mount, and coax removed from my car when I drove into the parking garage at Logan International Airport in Boston... a high-profile antenna in a low-profile environment. Another case: Using a 5/8-wave mag-mount antenna for two-meter FM, I lost the whole shebang when it blew off the car at speed (yes, it *was* a bit over 55). Once again, I had become used to the flutter, the QSB, the pruning to length, the removal of the whip before driving into my own garage... all nuisances for those of us who operate mobile.

The answer to all this came to Jim in a flash—use a rugged, low-profile antenna of solid construction. Enter the DDRR.

The CR2A antenna has a considerable height reduction over that of full-sized verticals. This lowers wind resistance and completely eliminates mobile flutter (picket fencing). The extremely low angle of radiation enables the directional discontinuity ring radiator to compare, most favorably, with most full-size units. The feed system connects the antenna directly to ground, which provides an automatic static drain from charges induced by fog, dust, and precipitation, affording an improved signal-to-noise ratio.

The DDRR has been around a long time. It was developed for use in hostile environments and in instances where lots of abuse could be expected but had to be withstood. One of the first articles about the DDRR, or "Hula Hoop" antenna as it has been called, was by J. M. Boyer in *Electronics*, January 11, 1963. He suggested that an antenna only two feet high could perform nearly as well as a 60-foot-high vertical antenna.

The problem had always been that when the vertical antenna height is reduced physically and resonance is achieved by loading with lumped reactance elements, efficiency drops drasti-

cally. In the new system, however, which Boyer termed a "leaky waveguide radiator," the circumferential aperture replaces the vertical height. The small height (only 2.5 electrical degrees) and the small diameter (about 28 electrical degrees; i.e., slightly more than a quarter wavelength) together with its ability to be tuned over a frequency range of about 2:1 and matched to transmission lines of between 36 and 500 Ohms make the DDRR an ideal antenna. Its only drawback is the need for it to be placed over the best possible continuous ground plane with very low losses. At two meters, of course, the steel automobile body serves admirably, but copper or aluminum would be even better.

Early models of the DDRR performed within a few dB of their full-size quarter-wave vertical counterparts at frequencies of between 2 and 4 MHz. However, as the frequency increased, so did the apparent efficiency (possibly because of the increased conductor diameter as a ratio to wavelength), and at 30 MHz, the DDRR was shown to be *superior* to a quarter-wave vertical antenna mounted to the same *ground plane!*

Two hams who have done extensive work with these antennas are W4MIP and W6UYH... and now Jim Waldron W1HGZ.

The Com-Rad antenna is formed of 3/8″-diameter stainless-steel tubing and is bolted to a chrome-plated roof-top magnetic mount. Stainless-steel hardware connects the single insulated wire from the mount to the ring, and a wide copper strap (actually phosphor-bronze strap about 3/8″ wide and .010″ thick) is connected between one end of the ring and a point on the circumference. The wire and the strap are adjusted to provide the lowest possible reflected power. A coaxial UHF-type chassis connector on the chromed magnetic mount is used to attach your 50-Ohm coax to the antenna, permitting it to lie flat against the car roof.

The tuning ring enables the band-center to be placed anywhere within the two-meter band and beyond, making the device useful outside of the amateur band. The tuning ring replaces the variable capacitor used with conventional DDRR designs and broadbands the system by making a large loop at the voltage end of the antenna. The high-Q of the device provides increased selectivity during reception, minimizing adjacent channel interference, image response and crosstalk. The low profile eliminates entanglements with trees, and it doesn't need to be removed from your car when you park in a garage. The low profile and magnetic mount make it easy to operate the antenna virtually anywhere a square foot of ground plane exists.

How does it work? Well, let me give you an example. As soon as I received the antenna, I mounted it on the car roof and connected it to my NDIHC-1400 two-meter synthesized transceiver by means of a piece of RG-8/U. First, I should explain that the terrain here in New Hampshire is extremely hilly. Repeaters are on hilltops here, as everywhere, but there is an awful lot of rugged terrain in between, and many shadow areas. Consequently, many of us use beams to hit the repeaters from our homes, and (at the very least) 5/8-wave whips on our cars. With a good 5/8-wave whip, and the car parked in the driveway, I can usually bring up about four or five New England repeaters, including the Derry machine, the Mt. Greylock machine, and several others. With my quarter-wave whip, things are a bit tougher. I usually have to go to the top of the mountain to bring up the machines...all except for our local repeater in town.

Thus it was with considerable interest that I put the silly-looking (but tough and rugged and low-profile) Com-Rad DDRR on the car. What the heck, I couldn't do *worse* than the whip...or *could* I? So, I scanned the band...and wait a minute! I'm hearing many repeaters. One after another, I listened, called, and "made the machine." I got good reports (full quieting) and scratchy reports, but I got out—eight times... Eight different repeaters!

The crowning achievement was making the Topsfield, Massachusetts, repeater—about 70 miles distant and on the *other* side of the mountain behind which my QTH lies. Okay, I'm not going to tell you that the Com-Rad DDRR antenna has to be for *you*. All I can say is that it's going to be *my* antenna for two-meter FM mobile from now on. It's strong, it's easy to tune (covers a range from 143-150 MHz and matches 50-Ohm coax at near unity swr), it has a low profile, it's small (not much larger than a saucer), it works like a bandit, it can be removed or replaced in seconds, and it has *no* mobile flutter. Besides all that, it's, well...er, ah...*gotta* say it...kinda cute, and a sure conversation starter wherever you go.

The price of the CR2A is $39.95 (plus $2 postage) delivered to your door, mag mount included, pretuned to about 146 MHz and matched to 52-Ohm coax. For more information about this and other space-saving antennas, write Jim Waldon at *Com-Rad Industries, 1635 West River Parkway, Grand Island NY 14072.* Reader Service number 477.

Jim Gray W1XU
***73 Magazine* Staff**

ROGO CW SOFTWARE

Over a year ago I read an advertisement in *73* for a Rogo Computer Products program that could run CW on a TRS-80. I was a little skeptical, but at the price offered ($19.95), I wouldn't lose too much if it turned out to be a lemon. I had previously tried several other products that didn't work too well on the Model I.

Response time was very fast; I had the product back in less than a week. I received a tape with the program on one side and a message in Morse code at 30 wpm on side B. The documentation was a ten-page leaflet.

The program has two parts, a machine-language loader and the Basic program. Once the tape is loaded, you type RUN and the machine-language driver is POKED into memory. The program then deletes those lines of the program and returns with a second prompt. You type RUN again and you are now in transmit mode. The program will ask you for CALL, RST, & WPM. You can now access the receive mode by pressing the "*" key and answering the prompt with the estimated receive speed. You can now run your demonstration tape.

Interfacing is really simple and adequate instructions are given. Rogo recommends that you key the transmitter with a keying transistor actuated by the audio out of the cassette port. I key my FT-902DM transceiver this way. You can also key your rig with the TRS-80 internal relay or with an external relay. Again, adequate schematics and information on program changes are given.

The program works almost flawlessly on receive. I have compared it with several other products and I have to say Rogo's works best. I have copied CW at over 100 wpm without any problems. Audio is fed into the audio-in cassette port. They recommend that you adjust your receiver so that the note is about 2200 Hz. The received CW also is stored in memory if you protect memory on initialization. On the upper right corner of the screen, if a character is being stored, it will display the character as it is being put to memory. There is a command that can later recall the stored CW and print it in the screen, output it to a line printer, or resend it as CW. You can clear your buffer at any time. The receive program also prints out on the line printer simultaneously as it is receiving. The program outputs to my Microline-80 printer one line at a time during receive. The program does not look for a busy signal from the printer, so there are no program hang-ups and you do not have to worry if the printer is on or not. I have used the program to copy W1AW bulletins and later print them out. It seems to be very tolerant as to sloppy fists and to speed tolerances. If your speed selected is incorrect, simply hit the ENTER key, the program will tell you the actual speed of the received signal, and you can then enter a new speed.

The transmit program can be sent from either the keyboard or from a selection of messages you can permanently put into your program. All customizing instructions are very complete. You can insert the other station's call and RST on initialization of the beginning of each time you go to the transmit mode and then send it out with one key command. There is a CQ command that sends out CQs, pauses for about 10 seconds, and then calls CQ again until the keyboard is interrupted. The only problem with the transmit program is that you can only type ahead one character. I have used a FIFO utility to create a buffer with limited success.

The program comes in 16K or 32K and can operate on a Model

I or III. The Instructions tell how to convert the 32K program to disk. All In all, it is well worth the money.

For more information, contact *Rogo Computer Products, 4752 DeBeers Dr., El Paso TX 79924.* Reader Service number 478.

Charlie Milhans KC0CE
Fort Devens MA

PALOMAR SWR AND POWER METER

No matter how you look at it, Palomar Engineering's model M-827 swr and power meter is a unique product and the result of a unique idea...so much so, in fact, that a patent has been applied for.

What can be so different about an swr and power meter, you say? Well, the display, for one thing...LEDs that show both swr and output power simultaneously. These are arranged in two side-by-side vertical columns on the front panel of the meter and light up when rf power (and ac power, too, I must say) is applied. The swr value appears in the left-hand vertical column. The swr scale is logarithmic and is graduated in increments that read from a value of 1:1 up to a value of 10:1, while the output power scale depends upon which range switch can accommodate powers from 0-20 Watts, 0-200 Watts, or 0-2000 Watts, at any frequency between 1 and 30 MHz.

The M-827 is fully automatic, which means that you don't have to set either a *set* or *sensitivity* control when measuring either swr or output power. All you have to do is plug the unit into the house mains (115 volts ac), attach your antenna and transmitter coax, and set the range switch to the peak output power anticipated: 20, 200, or 2000 Watts. A built-in computer automatically sets the full-scale range so that your reading will always be correct. The light-bar, or segmented LED display, is instantaneous, following voice peaks on SSB or keyed characters on CW...meaning that there is no meter lag and permitting continuous monitoring of the essential facts of your transmissions: Are you putting out power, how much, and is your antenna operating normally?

The logarithmic display of swr is useful because at the very low range of swr, the adjustment or tuning of an antenna tuner can be critical, and it is difficult to get those tiny and exact adjustments to ensure a perfect match every time.

For example, I can adjust one of my antennas to read down to as low as 1.02:1 swr. The analog computer and digital comparator in the circuit show exact relationships between output power and swr, meaning that you know at all times just where you are in the antenna and transmitter department. Besides all that, it is plain fun to watch the little red columns fill up or empty as conditions change, and what's more, you can do it in the dark! Maybe I'm one of the few hams who like to operate in the dark, or at least with reduced ambient lighting in the station, but under these conditions conventional metered swr meters and power meters are almost impossible to read. Not so the M-827, which can be seen under virtually all conditions of ambient light from brilliant sunlight to darkness.

The M-827 makes a very nice station accessory, in addition to being useful, because it is also small and attractive. The dimensions of the metel case are 4″ x 4″ x 5″. The top and sides are finished in black vinyl, while the front panel is a neat and conservative brushed aluminum. A power cord for 115-volt, 50/60-Hz ac is furnished (supply built in) and two SO-239 chassis connectors are provided on the back panel, one for input from the transmitter and the other for output to the antenna or to the tuner.

Having owned and used many different types of reflected power meters, I was most anxious to try this new one and to see if it would be compatible with my station and my operating needs. It turned out to be both. I used it to tune and calibrate my new R-3 antenna (report elsewhere this issue) and to measure output power and swr on my other antennas...all of which turned out (thankfully) to have less than 1.5:1 swr. I was also surprised to learn that the output of a popular-brand transceiver that I use is considerably less than what I have been telling hams on the air.

Since the little Palomar swr and power meter works so well, I am looking forward to Palomar's new 300-Watt-range antenna tuner so that I can connect the two and run some experiments on a bunch of different wire antennas that I've had in mind for some time.

Need I mention that due to its small size the M-827 would be an ideal portable companion to take along with your rig to that vacation QTH? That's where mine is going, if I can ever get the time to take a few days off to do some laid-back hamming.

Finally, you don't have to believe everything I say about this little gem from Palomar Engineering. Get one yourself and find out that I wasn't kidding...it's *great*, and I recommend it highly.

For more information, contact *Palomar Engineering, 1924-F W. Mission Rd., Escondido CA 92025.*

Jim Gray W1XU
***73 Magazine* Staff**

LETTERS

ION CHOICE

As a government employee, and therefore one who is often concerned with maintaining a proper office enviroment, I was intrigued by the July, 1982 constuction article on the negative-ion generator. I promptly built one, installing it in a decorative plastic vase (complete with decorative plastic flowers) in my decorative plastic office. It seemed to work, improving the atmosphere around the "salt mine." But all this improved atmosphere seemed to be at odds with the usual need for office dissention, so I modified the design by adding a second generator, wired to generate *positive* ions, with a concealed switch to select between the two. Now, I can have my choice of office environment to match my mood; sweetness and light or hate and discontent, all at the throw of a switch. Technology marches on!

T. Bills KG6JFX/5
NSTL Station MS

"ADMIRAL RICKOVER"

At age 56, I must admit that I sided with the old ham fraternity that the code requirement be kept intact. However, as time goes on I am beginning to see your point of view. Please keep up your aggressive stand to reduce the code requirement as a barrier, and to subsitute a more comprehensive and tougher theory exam. We do need younger folks entering the ham radio field...keen minds that enjoy experimenting and developing. I am afraid this energy is being drained off by interest in computers and video fun and games.

In talking with a ham dealer the other day, I sensed that our lackluster sales of ham equipment is not just the economy, but a need for a spark in the radio field. Two meters gave us that newness some years back and now this interest is fully developed and has hit its plateau. Relaxing the code requirement could bring about this second wave and burst of interest we all need. The ARRL should sense this, looking at the long-range picture, and join forces with you. Only the ARRL can bring about a change of mind in the ranks.

I recall my own interest in electronics, radio, and radar in World War II in the Air Force. All my instructors were hams and my personal interest and knowledge of the subject was the result of a next door ham operator who taught me the fundamentals.

I saw USA military helping to train British radio operators and technicians in World War II because our young folks were more knowledgeable. We need this trained back-up civilian group for the future.

You may well be our "prophet" or our "Admiral Rickover" with a better long-range view than most of us. Unfortunately, many see you as a so-called competitor of *QST* (ARRL) and

your views get clouded because of that situation.

Keep up your stand. You have at least convinced me that your ideas are sound.

Ervin Jackson, Jr. N4BIG
Charlotte NC

73 AUTHORS

In this day and time when everyone is writing to you, chewing you out for one thing or another, and complaining about this and that, I thought I would write you a "happy letter."

I have been a continuous subscriber to *73 Magazine* since 1968 and a charter subscriber to *80 Microcomputing* since the beginning. Your viewpoints, due to your first-hand experience and your age, I have totally agreed with, ever since your days at *CQ*.

Wayne, I don't know what it takes to gather a staff and to put out a magazine, but I'm going to tell you about one person's experience—a person with very limited knowledge and many questions to ask about everything. I have built many, many projects out of the pages of *73*. I have built and tried to understand many things out of *80*. In both cases I must admit that I couldn't have accomplished anything without the kind help of the authors of the articles. I don't know where you get these people, Wayne, but there is not a more dedicated group of people anywhere on this Earth. I don't give a tinker's damn whether I make a mistake on a program or there is a misprint in an article—I always know I can write the author and get help, and so far, over the years, with 100 percent response. Now how do you like them apples?

In years gone by, I have started several expensive projects from the pages of some of the other magazines and when I ran into a problem, I wrote the author. After all, his address is printed along with his name. I got absolutely no response, and this was after letters, telegrams, and phone calls. I even had one *QST* (well-known) author tell me to "go to hell you stupid bastard" when I was paying for the phone call and only wanted a simple question answered. Not so with *73* and *80*. I get only very quick responses, and over the years, have gained new and valuable friends who, after months have gone by, take the time out of their own busy schedules just to drop me a line and find out how I'm doing with their particular program or circuit. Hell, Wayne, what more can a person ask?

The world is in one hell of a mess, and everyone knows it. But there are a lot of dedicated human beings out there, like yourself, who feel a little sorry for the other guy and can take the time to give a helping hand to someone who might not be as well educated as they are or not have the experience that they have. Can you believe all this for the simple outlay of twenty cents and an envelope? Well, I can.

I don't want to take up your time, Wayne, because I know you are busy. I simply wanted to let you know that there are a lot of people out here who appreciate all that you are fighting for, as well as what you stand for, but who may not have the time to write and let you know. If you want to publish this, I would appreciate your not using my name. I don't wish to cause any embarrassment to anyone. Keep up the good work, pal.

Name and
Address Submitted

First nice letter in months and he wants his name withheld for fear of repercussions. Boy, what a fan club I've got!—Wayne.

SURVIVING

After reading the letters "No Nukes I" and "No Nukes II" (*73*, July, 1982), I felt that I ought to add my two cents worth.

The letter writers object to "Surviving the Unthinkable," an article which appeared in the May, 1982, issue of *73*, which suggests EMP-hardening of amateur installations. The writers seem to feel that it is possible to avert a calamity by remaining unprepared. By that reasoning, to prevent fires we should get rid of fire extinguishers and fire departments; to prevent burglaries we should avoid using locks.

The assumption that there would be no survivors after a nuclear detonation must never be used as a starting point for deciding what to do. If you are on a sinking ship, the only constructive strategy is to assume that you *will* survive and to act accordingly. If you go down after all, well that's the way it is. But if you *assume* there is no hope, and you don't do anything to help yourself, then you will go down for sure (and you deserve it).

To be unprepared is to invite trouble. As an example, review the events leading to World War II, especially those of 1939 and 1941. If you are unable to stop them, someone will take advantage of you; examples are the "woodpecker," also broadcasts (sporadically) on 10.000 MHz (jammimg WWV time and frequency-standard transmissions), the Falklands episode, Afghanistan, and others. Someone once said, "Those who don't learn from history are doomed to repeat it."

So, let's pray that a nuclear conflict will never happen. But for heaven's sake, let's not announce to the world that we intend to be unprepared, and that we will give in to anyone who threatens us. If we do, you can bet your bottom dollar someone will.

Hans Schroeder AE9G
Milwaukee WI

10 WPM

I think you fail to recognize the one major advantage of CW. It is the only mode which can be sent and/or received by any combination of equipment, from the most primitive (keyed oscillator/superregen receiver) to the most sophisticated (computer-controlled keyboard and printer). Try copying even the slowest Murray from a pair of cans, or sending ASCII with a straight key, and you will begin to appreciate the universality of CW. What I believe is really needed is a reduction in the code-speed requirement for General and Advanced to 10 wpm. This, besides complying with the International Agreements, eliminates that plateau which discourages so many would-be hams. Anyone who further pursues CW will automatically increase his/her speed, and the others lose their edge anyway so there really is no loss.

As for the Bash books, any good teacher can tell you that there are many ways to reword the same question so that a memorized answer will not suffice. The FCC could easily have a hundred versions of the same exam if they desired. Then these "guides" would be nothing more, just guides. By the way, in case you've been out of college too long, study guides are very useful in that they reduce the nervousness before an exam by proving to you that you *do* know your subject.

George Gray WB2CHP
Spring Valley NY

By George! You're right. All we have to do is get after Reagan and get him to increase the money to the FCC so they can write more tests and frustrate Bash bookers. The recent cuts in FCC funds brought about a severe cut in the amateur radio division... and more cuts are in prospect. Let's get Reagan busy on getting some of the missile money into the ham division of the FCC so we can have better tests. On the code, since polls show that most hams want the code test to stay, let's make the code so it really is the filter everyone wants and will keep out the fruits and nuts. Let's make the Novice code test 35 wpm and the General 45 wpm. Advanced could be moved to 55 wpm and Extra to 75 wpm. Or we could simplify the whole thing by splitting it in the middle and having one speed for all further licenses: 50 wpm. We can cut down on Bash's income by having just one class of license... Extra. That would cut the cost to the FCC, with only one license test to give, and they could spend more time making it difficult.—Wayne.

COMPROMISE

As to the no-code license, there seem to be two schools of thought on the idea, with neither side willing to give an inch. I feel that the "Let's-keep-the-code group" is broken down into two subgroups. One subgroup feels it would ruin amateur radio and the other has the attitude... "I got mine the hard way, let everyone else do the same." I disagree with both subgroups. But, that's not to say either group is entirely wrong.

Why not a compromise? Why not a six- or seven-wpm code test? Who says that thirteen wpm is the magic speed that makes you a licensed amateur and a good ham radio operator? How many operators pass their General test only to put the key away for good? How many Generals could pass a thirteen-wpm test right this moment? Isn't

theory, good operating procedures, and knowledge of all the rules and regulations more important than being able to copy thirteen wpm?

Of course there are a lot of darned good CW operators on the bands and the thought must come to mind that if CW was not a requirement, what would happen to the CW portions of the bands? That is one of the reasons why we should compromise and keep some CW requirements.

I would like to ask the "I-got-mine-the-hard-way subgroup" if they still add and subtract by hand as they were taught in rammar school.

To the subgroup that feels hat it would ruin amateur radio, et me say I see no reason why nowledge of more than six-pm CW would be of any value o operating in the RTTY, SSTV, M, SSB, ATV, or FM modes. If ou feel that the same people ho ruined CB would then move p to ham radio and ruin it, I ould not disagree more. First of ll, most of these people don't ven hold CB licenses, so why would they bother to get an mateur license? Why don't they just move to our bands and perate in the same illegal maner as they are accustomed to in their own bands? What is to top them? A thirteen-wpm code test? I can't buy that.

As to the no-coders (to which belong), let's face reality, it ust isn't going to happen on he HF bands. So why not compromise?

Wayne, as I indicated to you earlier by a copy of my letter to he FCC, I feel that the Technician class should be able to operate in a voice portion of the 10-meter band. I would like to hear comments on that idea as well.

Joseph D. Kelly N2CCV
Wildwood NJ

Joe, we're sure beating this code thing to death with blather. But never mind, I'm still able to imp to my typewriter and write about it. Firstly, six words per minute? Horsefeathers! Apparently you are unaware that the 13-wpm speed was picked with fiendish delight by our long lead torturers. That speed was not picked at random. You see, though we are just in recent years learning how the brain works, the empirical tests showed us that there was a plateau at around ten words per minute. The old-timers didn't know why this was, but they did know that, using the code-learning techniques of 1910, this was a formidable obstacle to learning the code at any reasonable speed. So naturally they set the speed required for a ham ticket just above this plateau. Before they pulled this beaut the code speed for a ham ticket was 10 wpm and few people had much trouble with that. The 13 wpm weeded out 90% of those trying for the license... a much more satisfactory situation for the old-timers interested in keeping the bands from getting too crowded.

We now know that the old-fashioned code-learning system called for one side of the brain to set up a look-up table (to use computer terms). The other side of the brain received the signal, sent it over to the other hemisphere where it was checked against the table, and the resulting letter found, this message was sent back so it could be written down. The problem came when the speed of transmission of the brain was reached... at around ten words per minute. Beyond that the brain could not look up the characters fast enough and frustrations set in which usually resulted in the candidate giving up.

The brain had to respond by giving up that whole method of translation of the sound patterns and throwing away both the look-up table and the oscillation of the information back and forth between the two halves of the brain.

Now we know that what happened was that the brain set up a whole new system whereby the sound patterns were equated to the writing of the letter or the typing of the letter, without the problem ever having to be referred to the other part of the brain. This is done on a subconscious level and is quite automatic. This is why good code ops are able to sit and talk with you while copying code. They don't have to listen on a conscious basis at all.

Now, in order to get code learned using this system of brain work, it is necessary to develop the automatic process. Modern code-teaching systems start out with code at 13 wpm, which keeps the look-up table syndrome out of the picture. They space the sounds to give the brain time to set up the translation patterns... not to tell you what the characters are one by one, but to cause your fingers to write them. The brain adapts to the sound patterns quickly with this approach.

Obviously, if you are going to go up to 20 wpm for the Extra-class license, you don't want to gradually speed up the code, you want to change immediately to 20 wpm and retrain the subconscious to recognize the new sound patterns... and write the letters. This is why people using this system of learning are able, in many cases, to start right in at 20 wpm and, within a couple of days, be copying away.

You know, I've tried to get the League to stop using the 1910 code-teaching system for almost 20 years. I eventually gave up and put out my own code tapes. Suddenly, thousands of people who had virtually given up on ever passing the code test found out that it was duck soup. I'll bet I've had over ten thousand hams tell me that my code tapes got 'em through... often after repeated failures with other systems.

Okay, so much for that. My apologies to readers who have been through that story before, but for some reason it always seems to be news to some.

The enthusiasm of many hams for CW and their insistence on all newcomers having to pass a code test as a way to ensure that they will enjoy code is, at best, faulty psychology. People don't work that way. Hells bells, I enjoy RTTY, but I know that if I try to force people to learn about it they are going to react the way any rational person does: they are going to resent being forced. No, if we made CW use a matter of pride rather than something our government forces us to do, I know that we would have a lot of CW enthusiasts.

The people of Russia and China may have gotten used to slavery, but we here in America haven't. Look at the resistance to the draft... which qualifies, I think, as slavery. It looks to me as if the CW fans have been doing the one thing which has most resulted in what they don't want: forcing people to learn the code resulting in antipathy to it.

Techs on ten meters? Sure, as soon as you get rid of the code as an element required for the General license.—Wayne.

SILVER PLATTERS

For the past six months I have been reading a lot of letters from readers concerning the no-code licensing. Our country is already burdened with give-away programs such as welfare. Now we have advocates of give-away amateur radio licenses.

I don't work a lot of CW, but I am one of the few people in this country who believes you don't get something for nothing. Do you get a medical or law degree, or even a high school diploma without having to learn some things that you may never use? No you don't, but as with the no-code licensing advocates there are probably those who would like give-away high school and college degrees. The problem is that too many people want to do away with requirements that keep them from taking the short cut.

The requirement for learning the electronic theory has already been done away with by Bash Publications, and now there are those who want to do away with the code test. As it now stands the only thing that keeps many from getting their amateur licenses is that they are too lazy to learn the code. Why don't we do away with the Dick Bash cheat sheets and keep the code test?

If the rules are not followed prior to getting on the air then what will happen after these people get their tickets? I suspect that these same individuals will break the rules and cut the corners after they have gotten on the air as they did prior to getting on the air. This is already occurring on the 2m bands in some of our larger cities.

In conclusion, I would like to say that if you don't want to work for what you want, then get your checkbook out and go to your local department store and buy a CB. All you need to do is fill out the form that is enclosed with the CB, send it to the FCC, and you are on the air. You will be right at home with the rest of your kind. I am not saying that all CBers feel that way, but I started out on the CB band and I knew what I wanted so I worked for my license. You can't get through life expecting everything to be given to you on a silver platter just because you don't want to pay the price. Let's all hope that amateur radio li-

censes are not handed to the same individuals on silver platters.

Jerry Leckness KD4XR
Tuscaloosa AL

Jerry, you either don't read carefully or else you have poor retention. You also have one hell of a negative attitude, for you had not one single positive suggestion about solving the problem of getting good hams. And I can't take your beef about the Bash books seriously until I see a copy of a letter from you asking CQ not to run his ads...or a letter to a ham dealer saying you're not going to buy from him as long as he sells those books. I have yet to hear of one single case where any ham has gone into a dealer and torn up the Bash books on display...not one. No, 100% of the hams have accepted this flagrant poisoning of our hobby. Not one single ham club in the country has taken a stand against Bash, so I must assume that 100% of the hams don't give a damn whether or not any newcomers have any technical knowledge...and that includes you, Jerry. Ham licenses are being handed out on silver platters and I don't see you doing anything but griping. The code doesn't prove anything. Some people can learn 20 wpm in a weekend, others can struggle for months and not get 5 wpm...that's a matter of chance and genes.—Wayne.

DIGITAL CODE

The FCC is doing ham radio amateurs a great injustice by not replacing the Morse code with a more viable alternative and by being reluctant to introduce computer technology into ham radio.

The Morse code, being a good base for communications, is at present outdated and not in step with our current technology. It remains for many a nostalgic foothold with the past—a good feeling of taking part in something that originated in past history. However, Morse code does not a true amateur make! There are many good hams around that had (and still have) the darnedest time learning the code to get their licenses. And then there are many code experts who are not good hams at all. There are also good hams who are good at code. A true ham radio amateur is one who has the proper spirit, attitude, and dedication to radio communications, no matter what the method used to communicate or the kind of ham gear used. There are many would-be amateurs who have the proper attitude but have a hard time getting their ticket because they cannot feel the rhythm of Morse code. This is akin to the person who either likes or dislikes classical, jazz, pop, or folk music. In many cases it means you either have it or you don't. This is very unfair to a true radio amateur.

As an alternative to Morse code, I would propose the FCC adopt a digital code. An exam would be given in two parts. In part A, the applicant would have to prove mechanical and proper operation of a basic keyboard encoder-decoder. In part B, the applicant would be given a test on digital-code theory to show understanding of what makes it work. This is not difficult and has its roots in Morse code basics—an on-off switch. As for buying the equipment, there are many economical systems now available, and by the time the FCC adopts such a resolution, prices would drop further.

As for computers and ham radio, it is the only way to go. It is not true that the human touch would be gone with computers, as many feel. Once again this is a vestige from the past. In contrast, the computer can allow the ham more room for human expression. An alphanumeric keyboard has limitless possibilities for personal touch communications. Those who criticize the computer don't understand its operation, don't own one, or don't know anyone who owns one and knows what it's all about. After all, a computer is nothing more than an off-on switch, the number of switches related to its capacity or memory, and the switching done electronically. In fact, a Morse-code keyer is a basic computer. So hams have been using computers for years, but they don't know it.

Roger E. Berube
Nashua NH

TERMINALL

apple* + TRS-80*

TERMINALL is a hardware and software system that converts your personal computer into a state of the art communications terminal. Terminall features simple connections to your computer and radio plus sophisticated and reliable software.

Simplicity

TERMINALL was designed from the outset to be easy to connect to your radio and easy to use. Plug into your receiver headphone jack and copy Morse Code or radioteletype (RTTY). Plug into your CW key jack and send Morse Code. Attach a microphone connector and send Baudot or ASCII RTTY using audio tones (AFSK). That's all there is to hooking it up.

The software is loaded into your computer from disk or cassette. Enter your callsign and the time and you will start receiving immediately. No settings or adjustments are necessary to receive Morse Code, it's fully automatic, and it works! You may type your message while receiving or transmitting.

You will be on the air, receiving and transmitting in any mode, in minutes. As we said, TERMINALL is simple.

More for your money.

■ TERMINALL has the RTTY terminal unit (demod and AFSK) built in. This results in a lower total cost.

■ **Fantastic Morse reception.** Six stage active filter demodulator copies the weak ones. Auto adaptive Morse algorithm copies the sloppy ones. Received code speed displayed on status line.

■ **Outstanding documentation.** Professionally written, 90 page user manual contains step-by-step instructions.

■ **Built in, separate, multi-stage, active filter RTTY and CW demodulators.** No phase lock loops. RTTY demodulator has 170 and either 425 or 850 Hz shift (keyboard selectable) and uses either the panel meter or scope outputs for easy tuning. Copy the weak ones. Copy the noisy ones. Copy the fading ones.

■ **Built in crystal controlled AFSK.** Rock stable for even the most demanding VHF or HF applications. A must on many VHF RTTY repeaters.

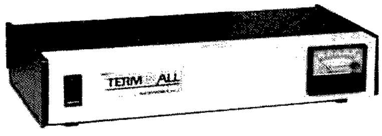
■ **Built in 110 or 220** volt AC power supply.

■ **Built in parallel printer driver software.** Simply attach a parallel ASCII printer (e.g. the EPSON MX 80) to your printer port to obtain hardcopy in all modes.

■ **Multi level displays** allows examining and editing of historical text.

■ **Word wrapping,** word mode editing, diddle, ignore carriage returns, user programmable end of line sequence, adjustable carriage width, multiple user defined WRU, transmit delay (fixed, none or auto adaptive), break mode and more!

■ **The all-in-one TERMINALL design** makes it great for use on HF or VHF, Ham, Commercial, SWL or MARS! SWL's TERMINALL may be jumpered for either 425 or 850 Hz reception to copy news and weather services.



System Requirements

TERMINALL T1 Communications terminal for the TRS-80 Model I. Requires a Model I TRS-80, 16K RAM and Level II BASIC. Includes software on cassette and disk, assembled and tested hardware and an extensive instruction manual. **$499.**

TERMINALL T3 Communications terminal for the TRS-80 Model III. Requires a Model III TRS-80, 16K RAM and Model III BASIC. Includes software on cassette and disk, assembled and tested hardware and an extensive instruction manual. **$499.**

TERMINALL T2 Communications terminal for the APPLE II. Requires an APPLE II or APPLE II PLus with 48K RAM and disk. Software is provided on disk in DOS 3.2 format. Use MUFFIN utility to convert to DOS 3.3 format. Includes software on disk, assembled and tested hardware and an extensive instruction manual. **$499.**

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NEW PRODUCTS

OSCILLOSCOPE MULTIPLEXER

Global Specialties Corporation has introduced an oscilloscope multiplexer that extends the capability of any oscilloscope from one to two input channels to eight, permitting a direct comparison of simultaneous events.

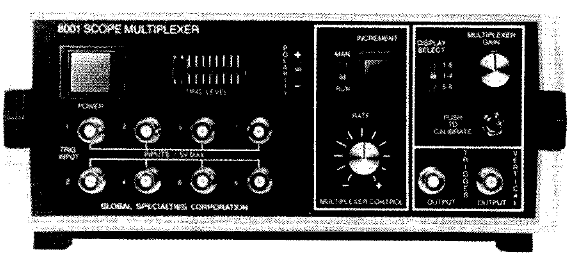
The model 8001 multiplexer accepts signals of ±8 volts (10 volts peak-to-peak) through eight BNC connectors and provides a flat frequency response to 12 MHz and only −3 dB at 20 MHz. Input impedance is 1 megohm.

The user can view all eight channels at once, or either of two four-channel combinations: 1-4 or 5-8. Once the overall relationship of input signals is observed, the operator may zero in on a particular signal by using the manual mode of operation and then using the increment switch to select the desired input signal (channel).

In use, the trigger signal is connected to channel 1, where its polarity may be switched and its level varied over the ±5-volt range. A "push-to-calibrate" button zeros all channels for scope calibration, leaving only the vertical display gain to be adjusted.

The model 8001 oscilloscope multiplexer can be used for field service of electronic equipment, for monitoring several signals at once, for looking at families of data originating from different sources, and for many other purposes. Suggested retail price of the model 8001 is $349.50.

For additional information, write *Global Specialties Corporation, 70 Fulton Terrace, New Haven CT 06509-1942.*



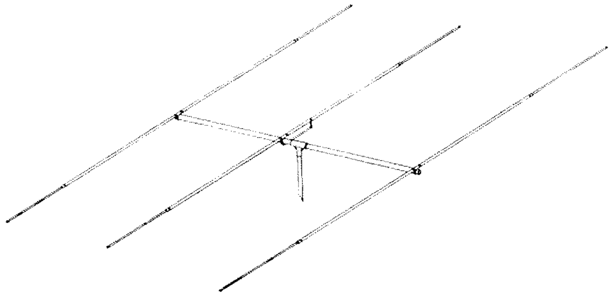
Global Specialties Corporation's oscilloscope multiplexer.

HUSTLER ANTENNAS

If six-meter operation is your dish, you will be interested in three new antennas recently introduced by Hustler, Inc. The 6-MB3 three-element yagi features a 6-dB forward gain while maintaining a front-to-back ratio of 28 dB. Bandwidth for a vswr of less than 2:1 is 2 MHz, and at resonance centered on 50.1 MHz, the vswr is under 1.2:1. The suggested retail price is $69.95.

Model G-3754 is a vertical, endfed collinear, omnidirectional antenna for fixed station use, and is ideal for repeater applications. Bandwidth for a vswr of under 2:1 is 1 MHz and, at resonance, is 1.2:1.

Hustler's endfed collinear.



Hustler's 3-element yagi.

Gain is 3.4 dB, developed from a .65 wavelength radiator. The SRP is $89.95.

The G-3754 and 6-MB3 are constructed of high-grade seamless aluminum tubing and stainless steel hardware for durability and long life.

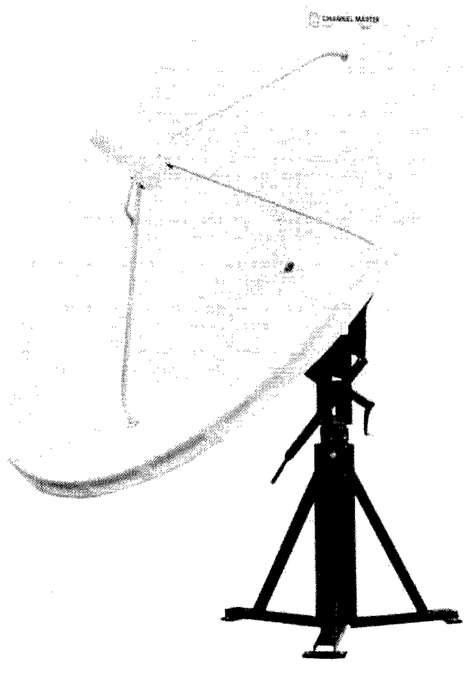
For mobile use, the new BBL-4554 base-loaded antenna is 48 inches in overall height and is shunt-fed, providing optimum performance on FM, AM, or SSB. The antenna is supplied complete with stainless steel impact spring, ¾-inch hole mount, and 17 feet of RG-58/U coaxial cable with PL-259 connector installed. SRP is $39.95.

For further information, contact *Hustler, Inc., 3275 North B Avenue, Kissimmee FL 32741.*

CHANNEL MASTER EARTH STATIONS

A new feed assembly used in Channel Master's new generation Earth stations features a 120° or 100° LNA (low noise amplifier), scaler feed, and automatic polarizer. The LNA offers weather protection and reliability with a one-piece cast aluminum housing that is coated with a weather-resistant urethane finish. In addition, the lid is sealed with an elastomeric "O" ring for weather-tightness in an unprotected environment.

The scaler feed features re-



Channel Master TVRO Earth station.

duced spillover for minimum interference and noise pickup and gives .5-dB-gain improvement over conventional rectangular feeds. For optimum dish performance and ease of installation, the unit is factory pre-calibrated to the exact focal length from the reflector.

Waveguide-coupled to the LNA, the integral feed polarizer makes possible convenient dual-polarity reception and eliminates the need for complicated feed rotation or expensive double LNAs. The probe automatically assumes the correct position for any channel selected by the receiver, without additional polarity adjustments.

The turnkey system complete with 12-foot dish is $5295; with a 10-foot dish, $4995.

For further information, contact *Channel Master, Division of Avnet, Inc., Ellenville NY 12428; (914)-647-5000.* Reader Service number 483.

KALGLO'S SURGE SUPPRESSORS

Kalglo Electronics Company, Inc., has added a new Quad series to its line of surge suppressors designed to protect sensitive electronic equipment from damaging power-line transients, high-voltage surges, and electrical noise interference conducted along ac lines.

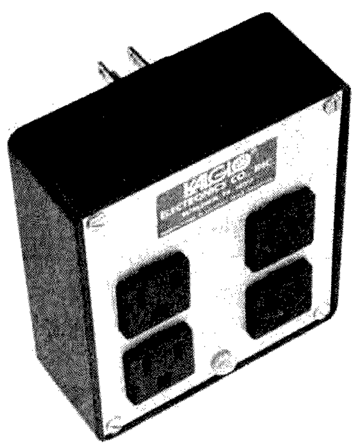
Quad surge suppressors have four filtered outlets, which take care of computers which need more than two filtered outlets (such as the Apple, for example). The Quad-I has transient absorption only, while the Quad-II has transient absorption plus dual 3-stage low-pass filters for RFI "hash" filtering.

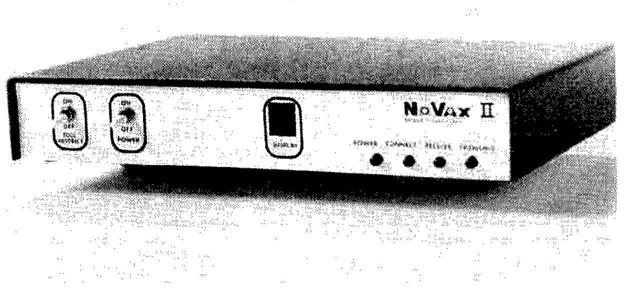
All units are prewired and ready to use. For more information, contact *Kalglo Electronics Company, Inc., Department Quad, 6584 Ruch Road, East Allen Township, Bethlehem PA 18017.* Reader Service number 486.

THE CES 635 MICRODIALER

Communications Electronics Specialties announces their new CES 635 Microdialer, designed to make life easier for the mobile radio operator. The 635 incorporates the microphone element and the keypad buttons on the *same side* of the microphone, enabling the mobile operator to put through an autopatch call without ever taking his eyes off the road.

The CES 635 Microdialer.


Kalglo's plug-in surge suppressor.



Current Development Corporation's Novax II mobile connection.

The Microdialer features a programmable pause that allows the operator to bring up the patch, pause, and dial the telephone number by pushing two buttons. It also keys the PTT line prior to sending the first tone so that nothing is lost in the transmission.

The first five memories hold up to eleven digits, and memories six through zero hold up to seven digits. Dialing speeds from one to eight digits per second can be programmed as desired.

The suggested retail price is $99.95. For additional information, contact *Communications Electronics Specialities, Inc., PO Box 507, Winter Park FL 32790.* Reader Service number 485.

NOVAX II MOBILE CONNECTION

Current Development Corporation (formerly R.W.D., Inc.) announces its new Novax II Mobile Connection for interfacing with DTMF (TouchTone®) and rotary-dial telephones. In addition to the standard features provided by Novax I, Novax II offers: 4-digit access code, LED display, toll restrict, repeater use, and rotary-dial-interface capability. Both units employ high-speed switching techniques, eliminating voice-activated switching problems.

Suggested retail prices are: the base unit, $279.95; the rotary module, $49.95, and the ringback module, $39.95.

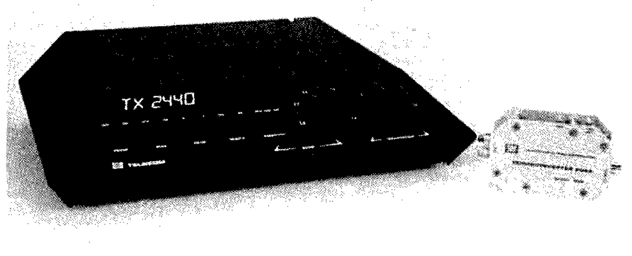
For more information, contact *Current Development Corporation, Box 162, Tudman Road, Westmoreland NY 13490.* Reader Service number 484.

SATELLITE EARTH-STATION RECEIVER SYSTEM

Telecom Industries Corporation has just announced their new TX-2440 satellite Earth-station receiver system. The receiver incorporates several unique features, including a three-position audio-subcarrier bandwidth selector, and an LNA-mounted, dual-conversion downconverter (patent pending) that enables any LNA to be converted to an LNC in seconds. The TX-2440 lists for $895. For additional information, contact *Telecom Industries Corporation, 27 Bonaventure Drive, San Jose CA 95134.* Reader Service number 491.

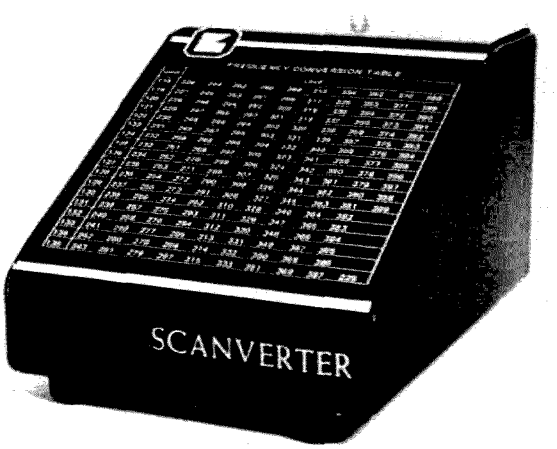
RIDGE SYSTEMS RTTY INTERFACE

Ridge Systems Co., Inc., has



Telecom Industries' new TX-2440 satellite Earth-station receiver system.

RTTY interface for the TRS-80 color computer, by Ridge Systems.



The Grove Enterprises 225-400-MHz scanner converter.

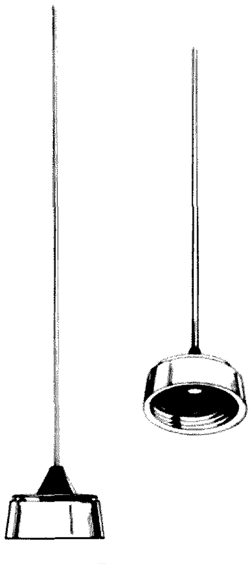
announced the model 4511 RTTY interface for the TRS-80™ color computer. The interface plugs into the Program Pak™ slot and contains all the software and hardware in a ROM cartridge. The five-pin DIN plug on the back of the cartridge provides the EIA signal connections to your terminal unit. Operating features include keyboard control of the message and operating buffers, transmitter on-off, station identification, and 110-baud-ASCII or 60-wpm-baudot mode selection. The split screen simultaneously displays text being entered, messages being received, and system status. Further, the interface firmware supports a printer and selective calling that automatically stores the incoming message on cassette tape.

The interface is designed to be reliable and easy to use. An internal buffer makes operation easier by allowing simultaneous text reception and text entry from the keyboard or permitting one to save incoming text for later re-transmission. The cassette tape permits you to save important or frequently-used messages and reload them as needed. The instruction manual describes installation and use of the interface and contains a schematic diagram, parts locator, maintenance data, and information on selected subroutines. $169.95 includes interface, manual, and 90-day warranty.

For more information, contact *Ridge Systems Co., Inc., PO Box 772, Acton MA 01720; (617)-264-4251.* Reader Service number 489.

MULTIBAND QUARTER-WAVE ANTENNA

Larsen Antennas has introduced the NMOQ special quarter-wave antenna which makes it unnecessary to stock a different antenna for each band.



The Larsen Electronics NMOQ quarter-wave antenna.

The NMOQ adapts one antenna for a full range of frequencies from 136 to 512 MHz. Just cut the rod to the desired frequency.

With a suggested retail price of $7.97, the Larsen NMOQ uses a chrome mounting nut and a silver-plated contact attached to the rod with a set screw. The silver-plated contact has less resistance than the stainless-steel rod and ensures a low resistance rf connection.

Two models are available. Order the complete antenna to fit the NMO mounting hardware, or the NMOQ Special W for the antenna without the chrome mounting nut. For more information, contact *Larsen Antennas, PO Box 1799, 11611 NE 50th Avenue, Vancouver WA 98668.* Reader Service number 488.

THE GROVE ENTERPRISES SCANNER CONVERTER

Grove Enterprises has just announced a new 225-400-MHz scanner converter, the Scanverter CVR-1, which will allow complete coverage of the 225-400-MHz military/federal government aircraft band when used with a standard aircraft band scanner.

Scanverter CRV-1 makes it possible to listen to NASA space-shuttle radio links to Earth, military air tactical war games, Coast Guard search and rescue missions, FLEETSAT-COM military satellites, federal government agencies in flight, and more.

A new development called "bandstacking" allows the entire 175-MHz-wide UHF aircraft band to be compressed into the 118-136-MHz range that is tunable on any scanner capable of standard VHF aircraft-band reception. No tuning or adjustments are necessary with the fully-automatic CVR-1.

Standard features of the Scanverter include: a high-sensitivity, low-noise microstripline circuit, an all-metal cabinet for superior shielding, a frequency-conversion chart printed on the cabinet, a double-balanced mixer for reduced images, an eleven-pole filter for suppression of out-of-band interference, a crystal oscillator for high stability, and a zener-diode voltage regulator for limiting drift. A power cord for connection to a 12-volt dc supply (not furnished) and an interconnect cable for connecting the CVR-1 to your aircraft-band scanner are also furnished. Suggested retail price is $99.95.

For more information, write *Grove Enterprises, Brasstown NC 28902.* Reader Service number 487.

TWIN OAKS ASSOCIATES' CW TEACHING SYSTEMS

Twin Oaks Associates is a partnership of mental health professionals who are hams interested in helping others to learn CW. Twin Oaks has developed three Morse code teaching systems on tape which represent the careful application of

psychological principles to learning. They help students learn to recognize and copy Morse characters at a very high speed.

The first set of tapes is called System 12©. It is designed for the ham who may have a Novice or Technician class license but can't "get over the hump" to pass the General class code test. System 12 takes students past 15 words per minute on five carefully-structured, successive-demand, 60-minute cassettes.

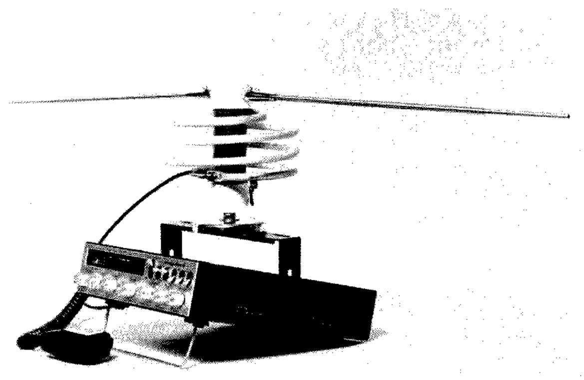
The second training program is called System 24©. It assumes that the student is able to copy comfortably at 9 or 10 words per minute but would like to go after the amateur Extra class license. This program is on five 60-minute cassettes and carries the student past 30 words per minute.

The third teaching system, the System 12 Alphabet Book©, is designed for persons who know absolutely nothing about Morse code. It may be used, however, by persons who are not thoroughly comfortable at 5 words per minute, and it is useful for either classroom or self-instruction.

Each program, or system, comes with its own carefully-written study guide. Systems 12 and 24 cost $30 each, and the System 12 Alphabet Book costs $15.

For more information, write *Twin Oaks Associates, Route 5, Box 37, Knoxville IA 50138.* Reader Service number 482.

COM-RAD INDUSTRIES ANTENNAS



A Com-Rad Industries' space-saving antenna.

Com-Rad Industries has just announced the availability of two new antennas in its line of space-saving antennas for fixed and mobile amateur radio operators.

The CR-1011A and CR-6A cover the amateur 10- and 6-meter bands, respectively. Each antenna is a full-sized quarter-wave vertical groundplane that has been rearranged mechanically to be only 5% of its normal height. It consists of a basic helic element with an adjustable telescoping capacity hat/tuning ring for resonating the antenna to the desired frequency.

Each antenna is constructed of stainless-steel hardware, aluminum helix elements, stainless-steel telescoping capacity hat, and corrosion-proof support structure.

The CR-1011A provides a low-vswr match to 50-Ohm coaxial cable over any preselected 400-kHz segment of the 10-meter band, and the CR-6A provides a low-vswr match to 50-ohm coaxial cable over any preselected 700-kHz segment of the 6-meter band.

For price information and further details about these and other antennas, contact *Com-Rad Industries, 1635 West River Parkway, Grand Island NY 14072.* Reader Service number 490.

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

LOGIC TIME

You know, time really does fly when you're having FUN! I can hardly believe it, but this month marks the second anniversary of the FUN! column. That's a lot of riddles and puzzles under the bridge, but it's been a gas. If you've had fun solving the quizzlers presented here, just remember that I've had even more fun creating them. So much fun, in fact, that it feels almost dishonest to take the money Wayne offers—but I really don't have much of a conscience.

I hope you'll enjoy this month's offering: some logic puzzles.

ELEMENT 1—MARC'S CONTEST

During a 24-hour contest, Marc can average two contacts per minute from noon to midnight and six contacts per minute from midnight to noon.

How many contacts will Marc average for the entire contest?

ELEMENT 2—THE DX QSO

A QSO on 20 meters the other night found four hams enjoying an international roundtable. All four operators were of different nationalities and although each could speak two of the four languages—English, French, German, and Spanish—there was no common tongue by which they could all communicate. Complicating matters even further, only one of the languages was spoken by more than two of the amateurs.

None of the hams spoke both German and French.

While Vic couldn't speak English, he acted as a translator for Carl and Dave.

Vic, Carl, and Larry didn't all speak the same language.

Dave could speak German, and rag-chewed with Larry, but Larry could not speak German.

Name the pairs of languages each ham spoke.

ELEMENT 3—COFFEE AND DONUTS AND MURDER

Four hams were standing together after a meeting of the Skunkville ARC enjoying the club's complimentary "coffee and donuts." Suddenly, one of the hams collapsed, moaned "I've been poisoned," and died. His fellow amateurs were arrested and made the following statements under intense questioning (one of the statements is false):

Hertz: I didn't poison him.
I was standing next to Farad.
We had the regular man buy the coffee and donuts.

Ohm: We had a new guy buy the coffee and donuts.
I was standing across from Watt.
The guy who bought the coffee and donuts didn't do it.

Farad: Hertz is a liar. We had a new guy buy the coffee and donuts tonight.
This new guy poisoned Watt.
Ohm is innocent.

Name the murderer.

ELEMENT 4—THE FRIENDLY REPEATER

Repeater station WA2DCS/R has some very touchy users. For instance, five members, whose first names are Harvey, Wally, Steve, Dick, and Stan, and whose last names in no particular order are Tracy, Walters, James, Phillips, and Lewis, have had so many arguments over the years that they will talk to each other only under the following conditions:

Walters will speak to only two of the others.

Phillips and Wally won't talk, but Steve and Lewis will.

Stan will speak to all but one. Harvey will speak only to one of the others.

There's only one out of the group that Tracy won't speak to.

There's only one out of the group that James will speak to.

Wally, Steve, and Dick all will talk with each other.

Give each ham's full name and the names of the other repeater users he will talk to.

ELEMENT 5—THE DXPEDITION

Four men set out on a DXpedition to put the Atlantic Ocean Isle of Long in the logbooks of amateurs around the world. Each of the men was employed in a different line of work than the others. There was an engineer, a stockbroker, an author, and an airline captain—and their names, in no particular order, were Steve, John, Doug, and Bob.

John is older than Steve.

The author and the airline pilot are brothers.

John is Doug's nephew.

The engineer had no relatives on the DXpedition.

The airline pilot is not the stockbroker's uncle, and the stockbroker is not the author's uncle.

What is each ham's job, and how are these guys related?

ELEMENT 6—THE TRAFFIC HANDLERS

Four Advanced-class operators and three General-class operators handle as much traffic in five days as three Advanced-class operators and five General-class operators do in four days.

Which class of operators is more productive?

THE ANSWERS

Element 1:
Three contacts per minute.

Element 2:
Vic spoke Spanish and French. Dave spoke Spanish and German. Carl spoke English and French. Larry spoke Spanish and English.

Element 3:
Farad is the killer.

Element 4:
The full names are: Steve Tracy, Wally Walters, Harvey James, Stan Phillips, and Dick Lewis. Tracy will talk to Walters, Phillips, and Lewis. Walters will speak only to Tracy and Lewis. James speaks to Phillips, while Phillips will talk only to Tracy, James, and Lewis. Lewis talks only to Tracy, Walters, and Phillips.

Element 5:
Steve is the engineer. John is a stockbroker. Doug is an author. Bob is the airline pilot. John is Bob's son and Doug's nephew. Bob and Doug are brothers.

Element 6:
The General-class operators.

SCORING

Each element is worth seventeen points. "Logic is logic. That's all I say."—Oliver Wendell Holmes.

1-20 points—Not rational
21-40 points—Semi-rational
41-60 points—With a ration of rationality
61-80 points—Rationalist
81-100+ points—Very smart

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CALIFORNIA QSO PARTY

Starts: 1600 GMT October 2
Ends: 2159 GMT October 3

Sponsored by the Northern California Contest Club, with strong efforts being made to have all 58 counties in California on for the contest duration.

Single-operator stations may operate only 24 hours of the contest period; off times must be clearly marked in the log. Multi-operator stations may operate the full 30 hours. Stations may be worked only once per mode per band. All contacts must be simplex. All CW contacts must be made in the CW subband. California stations that change counties are considered to be new stations and may be contacted again for points credit.

EXCHANGE:

California stations send QSO number and county. Others send QSO number and state, province, or ARRL country.

FREQUENCIES:

Novice—3725, 7125, 21125, 28125.
CW—1805, 3560, 7060, 14060, 21060, 28060.
SSB—1815, 3895, 7230, 14280, 21365, 28560.

Try CW on the half hour and 160 meters at 0500.

SCORING:

Each completed phone contact is worth 2 QSO points. Each completed CW contact is worth 3 QSO points. For multiplier, California stations use the number of states, VO/VE 1-7, and VY1/VE8 for a possible of 58. Others, use the number of California counties worked for a possible total of 58. The final score is the number of QSO points multiplied by the total number of multipliers.

AWARDS:

Certificates for highest-scoring station in each California county, each state/province, and each country. Certificates also to each station scoring 100 or more QSOs. Trophies to the highest-scoring out-of-state single operator, highest-scoring California single operator, and highest-scoring DXpedition to a California county.

ENTRIES:

All logs and summary sheets must be sent by November 1st to: NCCC, c/o Kip Edwards W6SZN, 1928 Hillman Ave., Belmont CA 94002. Please include an SASE with your entry.

CALENDAR

Oct 2-3	California QSO Party
Oct 2-4	Side Winders on Two Open QSO Party
Oct 9-10	GARTG Worldwide SSTV Contest (Part 2)
Oct 9-11	Side Winders on Two Open QSO Party (Part 2)
Oct 16-17	ARCI QRP CW QSO Party
Oct 16-17	Pennsylvania QSO Party
Oct 16-17	BSOA Jamboree-on-the-Air
Oct 23-24	Maryland-District of Columbia QSO Party
Nov 6-7	ARRL Sweepstakes—CW
Nov 13	Australian Ladies ARA Contest
Nov 13-14	European DX Contest—RTTY
Nov 20-21	ARRL Sweepstakes—Phone
Nov 20-21	Trinidad & Tobago QSO Party
Dec 4-5	ARRL 160-Meter Contest
Dec 11-12	ARRL 10-Meter Contest
Dec 19	CARF Canada Contest
Jan 8	*73 Magazine* 40-Meter World SSB Championship
Jan 9	*73 Magazine* 80-Meter World SSB Championship
Jan 15-16	*73 Magazine* 160-Meter World SSB Championship

GARTG WORLDWIDE SSTV CONTEST PART 2

Starts: 0600 GMT October 9
Ends: 0600 GMT October 10

This is the second part of a two-part contest—the first weekend was in April but rules were received too late for publication. The contest is sponsored by the German Amateur Teleprinter Group (GARTG). A 6-hour nonoperating time must be taken at any time during the contest. Use 80- through 10-meter amateur bands, SSTV mode exclusively. The same station can be worked only once per band. Operating categories include: a) SSTV transmitting and receiving stations and b) SSTV receiving stations (SWLs).

EXCHANGE:

Callsign, RST, message number as three-figure group starting with 001, and GARTG membership number as 5-figure group.

SCORING:

Score 1 point for all SSTV contacts on 80 through 20 meters, 2 points on 15 meters, and 5 points on 10 meters. Multipliers are each country of WAE and ARRL lists, including KL7 and KH6. Each W/K, JA, PY, VE/VO, and VK district will be considered as a separate country. The same continents and countries are valid only once on each band. Final score is QSO points times countries worked times continents. To this score add a 50-point bonus for each GARTG member worked.

ENTRIES:

Logs to contain date/time in GMT, callsign of station worked, RST and message number sent, RST and number received, and points claimed. Don't forget to list the GARTG membership numbers as bonus points! Logs from SWLs must contain both the full report sent and received by the station logged. Incomplete loggings are not eligible for scoring. A summary sheet should show the full scoring and please use separate sheets for each band. All logs must be received within 2 months of the contest and should be addressed to: Wolfgang Punjer DL8VX, PO Box 90 11 30, D-2100 Hamburg 90, Federal Republic of Germany. A free 12-month subscription to *RTTY*, the official organ of GARTG, will be sent to the 3 top scorers of group A.

JAMBOREE-ON-THE-AIR

Starts: 0001 GMT October 16
Ends: 2400 GMT October 17

It's Jamboree time again! Time for Scouts, former Scouts, and anyone interested, to meet on the air for a weekend of good Scout talk. It gives amateurs and Scouts worldwide a chance to listen to or talk with other Scouts. In some cases,

QSL OF THE MONTH: W7ILN

David F. Rollins of Las Vegas has the winning QSL this month. The idea is really novel. The basic design (shown here) is desert flora set off against a desert background. David colors the card with colored pens, and no two cards are exactly alike. The textured paper makes the color have "depth"—the color card David sent in is really superb.

If you would like to enter our QSL card contest, put your QSL card *in an envelope*, along with your choice of a book from *73*'s Radio Bookshop, and send it to *73 Magazine*, Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Entries which do not use an envelope or do not specify a book will not be considered.

SPLATTER!

NEWSLETTER OF THE MONTH

This month's winner is *Splatter*, the publication of the Radio Society of Bermuda. The newsletter is published in Hamilton, Bermuda. In addition to the usual club minutes, etc., the May issue had some interesting technical articles and an article on the world's biggest church, which was built by mistake. It seems that the architect's specifications were in feet, but the church was built in meters. *Splatter* also has a letter from the President of the Bermuda Radio Society with his comments on the proposed US phone band extension. In the news briefs departments, there is a note that the VP9 amateurs do not yet have approval to use the 10-MHz band. Although Bermuda is under the British flag, the amateur license structure in the colony is such that special approval is needed before new bands are authorized. Ah, bureaucracy.

Splatter has consistently good layout and its articles are always written in clear, concise language. A pair of charts, one each for resistors and capacitors, is included. The RSB announces their competitions in the newsletter and includes the appropriate forms, ensuring that all the members receive them in time. Cartoons and good drawings are in every issue, contributing to an overall outstanding newsletter.

The newsletter contest is enjoyed by us here at *73*, in spite of the work involved. We encourage all ham radio clubs in the US and overseas to send us a copy of their newsletter every month. We also like to get specialty newsletters such as those for VHF, DX, SSTV, RTTY, and so forth. There is always an array of outstanding newsletters. The competition is always close, so if your newsletter did not win this month, next month may be your turn.

where equipment is available for slow-scan television, to see them also. By the way, this also includes Girl Scouts, Guides, and all Scout leaders.

Look for stations at camporees and other Scout events and for K2BSA, the national headquarters amateur radio club station, and HB9S, the World Scout Bureau station.

Most operations will occur during the period of 0001 GMT Saturday to 2400 GMT Sunday, but since this is not a contest, operations may start Friday and go into Monday. No required contact format, no specific exchange, just Scouting fun. All operations must, however, adhere to FCC rules and regulations.

FREQUENCIES:

Scout frequencies published by the World Bureau are as follows:

Phone—3940, 7240, 14290, 21360, 51150.

CW—3590, 7030, 14070, 21140, 28190.

SSTV and RTTY on usual frequencies.

Post-card-size certificates issued by the World Bureau are available from JOTA Coordinator, Harry Harchar W2GND, 216 Maxwell Avenue, Hightstown NJ 08520, for anyone participating. Send one SASE with sufficient return postage—one ounce per eight cards. They may be requested before the JOTA weekend for distribution then, or for award at Scout Courts of Honor or other meetings.

Logs or lists of participants are *not required*, but reports of activity and photos are welcome for inclusion in the BSA report to the World Bureau and possible use in Scout publications. Send them to the JOTA Coordinator mentioned above.

PENNSYLVANIA QSO PARTY

1700 GMT Oct 16 to 0400 GMT Oct 17
1300 GMT Oct 17 to 2200 GMT Oct 17

Sponsored by the Nittany Amateur Radio Club, this is the 25th annual event. Stations may be worked once per mode (phone and CW) on each band. Mobiles may be reworked as they change counties. Repeater contacts are not permitted.

EXCHANGE:

RS(T), 3-digit sequential serial number, and ARRL section or Pennsylvania county. Stations on county lines will give out one number but the two counties will count as two separate multipliers.

FREQUENCIES:

SSB—3980, 7280, 14280, 21380, 28580.

CW—40 kHz up from bottom of CW bands.

Novice—10 kHz up from bottom of Novice subbands.

SCORING:

Count 1 point for SSB QSOs, 1.5 points for CW QSOs, and 2 points for 80-meter CW QSOs. Pennsylvania stations multiply QSO points by the total number of ARRL sections plus the total number of Pennsylvania counties plus a maximum of one DX country. Others, multiply QSO points by the total number of Pennsylvania counties worked (67 max.).

AWARDS:

This year, in addition to the usual certificates, plaques will go to top scorers in both Eastern and Western Pennsylvania, top out-of-state station, top mobile station (assuming at least 3 entries), and top multi-operator entry.

ENTRIES:

Logs must be complete, be legible, and include a summary sheet. Also include a dup sheet for entries with over 100 QSOs. Send logs no later than November 15th to: Douglas R. Maddox W3HDH, 1187 S. Garner Street, State College PA 16801.

ARCI QRP CW QSO PARTY

Starts: 1200 GMT October 16
Ends: 2400 GMT October 17

The contest is open to all amateurs and all are eligible for the awards. Stations may be worked once per band for QSO and multiplier credits. Participants may operate a maximum of 24 hours during the contest period.

EXCHANGE:

Members—RST, state-province-country, and QRP number. Nonmembers—RST, state-province-country, and power output. Novices and Technicians add /N or /T after the QRP number or power.

SCORING:

RESULTS

THE 1981 MARYLAND-D.C. QSO PARTY†

NON-MARYLAND STATIONS

Callsign	Total QSOs	Mult.	Score	Power	Mode
W2EZ	22	14	581	A	CW/SSB
WB2IPX	18	12	324	A	CW/SSB
W4FOA	13	10	195	A	CW/SSB
KA1HB	15	8	180	A	CW
WB1QLH	11	10	165	A	CW/SSB
AD8J/3	13	11	143	B	SSB
KF1B	12	10	120	B	SSB
W5PWG	12	6	108	A	SSB
WD8OYF	10	7	105	A	SSB
VE1RO	9	7	94.5	A	SSB
G5EBU	12	5	90	A	CW/SSB
NØCZO	6	6	54	A	SSB
N1RI	6	4	38	A	SSB
VE5AAD	3	3	13.5	A	SSB
WA7JUJ	3	3	13.5	A	SSB
KD4PP	2	2	6	A	SSB
N6CLV	3	3	4.5	A	SSB(QRP)
W2CC	1	1	1.5	A	SSB
WA3JXW	1	1	1.5	A	SSB

MARYLAND-D.C. STATIONS

Callsign	County	Total QSOs	Mult.	Score	Power	Mode
WB3CFD	Allegany	685	100	88500	B	SSB
WA3VUO	Howard	400	84	33800	B	SSB
WB3FNS	D.C.	188	72	20304	A	SSB
KS4B/3	St. Marys	206	55	16995	A	SSB
N3AC/M	*	70	38	3780	A	CW/SSB
WA3YHE	Montgomery	55	30	2475	A	SSB
W3ABC	Prince Georges	38	18	972	A	CW/SSB
WB3BSH	Dorchester	28	15	630	A	SSB
WA3EOP	Washington	18		#		SSB

*N3AC was mobile in Kent, Talbot, Cecil, Queen Annes, Baltimore, Frederick, Caroline, and Howard Counties.
#WA3EOP (check logs)
Power: A 200 Watts or less; B > 200 Watts.
Underlined callsign means awarded certificate.
†Next MDC QSO Party 1800Z Oct. 23 to 2100Z Oct. 24, 1982

Each member QSO counts 5 points regardless of location. Nonmember QSOs are 2 points with US and Canadian stations, others are 4 points each. Nonmember Novice and Technician contacts count 3 points. Multipliers are as follows: 4-5 Watts, × 2; 3-4 Watts, × 4; 2-3 Watts, × 6; 1-2 Watts, × 8; less than 1 Watt, × 10. Entries from stations running more than 5 Watts output will count as check logs only. Stations are eligible for the following bonus multipliers: if 100% natural power (solar, wind, etc.) with no storage, × 2; if 100% battery power, × 5.

Final score is total QSO points times total number of states/provinces/countries per band times the power multiplier times the bonus multiplier (if any).

Note: VHF/UHF contacts must be direct—no repeater contacts are allowed.

FREQUENCIES:

1810, 3560, 7040, 14060, 21060, 28060, 50360.

Novice/Tech—3710, 7110, 21110, 28110.

All frequencies plus/minus to clear QRM.

AWARDS:

Certificates to the highest-scoring station in each state, province, or country with 2 or more entries. One certificate to highest-scoring Novice/Technician overall. Entries automatically considered for annual Triple Crowns of QRP Award.

LOGS AND ENTRIES:

Separate log sheets are suggested for each band for ease of scoring. Send full log data including full name, address, and bands used, plus work sheet showing details and time(s) off air. No log copies will be returned. Please indicate if you are a Novice or Technician. All entries desiring results and scores please enclose a business-size envelope with return postage for one ounce or an IRC. It is a condition of entry that the decision of the ARCI QRP Contest Chairman is final in case of dispute. Logs must be received by November 20th to qualify. Send all logs and data to: ARCI QRP Contest Chairman, William W. Dickerson WA2JOC, 352 Crampton Drive, Monroe MI 48161.

MARYLAND-DISTRICT OF COLUMBIA QSO PARTY

Starts: 1800 GMT October 23
Ends: 2100 GMT October 24

Sponsored by the Columbia Amateur Radio Association, the contest is open to all single-operator stations. The same station may be worked on each band and mode.

EXCHANGE:

QSO number; RS(T); and state, province, country, or MD county. Remember that Baltimore and Washington are independent cities!

SCORING:

MDC stations multiply total QSOs by the sum of Maryland counties, states, provinces, and countries. Others multiply MDC QSO total by number of Maryland counties and independent cities (25 max.). Also, multiply score by 1.5 if running 200 Watts or less.

FREQUENCIES:

Phone—3950, 7250, 14290, 21390, 28590.
CW—60 kHz up from low end.
Novice—3720, 7120, 21120, 28120.

AWARDS AND ENTRIES:

Maintain a continuous log for phone and CW but indicate on entry which category—phone, CW, or mixed—you are entering. Certificates for top scorers in each category will be awarded. Mail logs, dup sheets (for over 200 contacts), and summary by November 30th to CARA, c/o Robert K. Nauman WA3VUQ, 4017 Font Hill Drive, Ellicott City MD 21043.

SIDE WINDERS ON TWO (SWOT) OPEN QSO PARTY

Part 1
Starts: 0000 GMT October 2
Ends: 0600 GMT October 4

Part 2
Starts: 0000 GMT October 9
Ends: 0600 GMT October 11

This is the fifth annual QSO party sponsored by the SWOT Amateur Radio Club and open to all licensed amateurs with operating privileges on two meters. All entries must be single operator and contacts must be direct—no repeaters or satellites. Contacts must be on SSB or CW and each station can be counted only once. All contacts must be made from one geographic location. Portables or mobile stations operating from more than one county may submit the highest score for any one location. There are no time limitations within the contest period.

EXCHANGE:

Callsigns, signal reports, ARRL section, SWOT number, and USA county or equivalent.

SCORING:

Contacts with SWOT members count 2 points per QSO, others count 1 point each. The multiplier is the number of counties worked. Final score is QSO points times county multiplier.

ENTRIES:

Logs should not be submitted unless requested. Send only a summary postmarked no later than November 1st to: Jerome Doerrie K5IS, Rt. 2 Box 72, Booker TX 79005. The summary should contain: your name, call, address, ARRL section, SWOT number, total SWOT QSOs, total nonmember QSOs, total counties, and final score.

AWARDS

TREASURE ISLAND DXPEDITION

The Garden State ARA (W2GSA) will hold its 3rd annual special event: the Treasure Island DXpedition, located in the Manasquan River, Monmouth County NJ. The event is to commemorate the stay of Robert Louis Stevenson on the island after he wrote the book of the same name.

Date: October 2-3, 1982; time: 1400 to 1400; frequencies: CW—3.535, 14.035; SSB—3.900-7.235, 21.375-28.725. QSL certificate: $1.00 to Lou Eloe WA2SSH, 7 Carol Ave., Neptune NJ 07753. No postage necessary.

NUCLEAR ANNIVERSARY

The Argonne Amateur Radio Club plans to operate the Club's memorial station, W9QVE, to commemorate the 40th anniversary of the first controlled nulcear chain reaction experiment. This experiment was conducted at the Alonzo Stagg field on the University of Chicago campus.

Two stations will operate from 1500 GMT on October 9, 1982, through 2300 GMT, October 10th.

Frequencies: SSB—3985, 7285, 14285, 21285, 28585; CW—3545, 7045, 14045, 21045, 28045, 3765, 7165, 21165 Novice bands; RTTY—14090 and 146.70 MHz; 2 meter—145.19/144.59 rptr, 146.52 and 147.42 simplex.

Send business-size SASE or $1.00 for 8 × 11 unfolded certificate to AARC, PO Box 275, Argonne IL 60439.

SUNBELT EXPO

The Colquitt County Ham Radio Society will be operating club station WD4KOW from the site of the fifth annual Sunbelt Agricultural Exposition on October 12, 13, and 14, 1982. The hours of operation will be 0900 to 1700 EDST each day.

This annual Expo is held each year at Spence Field Airbase, located near Moultrie, Georgia, and is the largest agricultural show in the South. This event draws over 200,000 visitors from all over the United States and foreign countries.

Operations will be in the General portion of the HF bands. The members will also be listening for visiting hams on the local repeater, 146.19/.79. Visiting hams are invited to visit the amateur booth at the Expo and operate the amateur station.

A special QSL card is available for those making contact during this event and submitting an SASE. For more information, contact Joel Goings AA4P, PO Box 813, Moultrie GA 31768, or call (912)-985-3620.

NEWNAN GA

The Bill Gremillion Memorial Radio Club will operate K4SEX for county hunters on Saturday, October 2. Frequencies: General-class portion of phone bands on 10, 15, 20, 40, and 80 meters. CW available. Send an SASE for confirmation to: Bill Gremillion Memorial Radio Club, PO Box 2327, Newnan GA 30264.

MOSCOW DXPEDITION

Moscow MI: The Hillsdale County Radio Association will hold its 2nd Annual Moscow DXpedition to Moscow, Michigan on October 16 from 1700Z to 1700Z October 17, under the call WB8HIZ. The frequencies to be used: 3.940, 7.280, 14.285, 21.360, 50.120, 52.525, 144.310, 146.57 MHz, or as band conditions permit. The exchange will be signal report, name, QTH (except Moscow station: serial number). All QSLs with an SASE will be answered with a 9"x11" certificate. Mail to: Ham, PO Box 206, Moscow MI 49257.

HERITAGE HOLIDAYS

The Coosa Valley Amateur Radio Club will operate from Rome GA from 1200Z October 9 to 2200Z October 17 to commemorate Heritage Holidays. 25 kHz on the lower side of the General-class phone band—80 through 20 meters. Special certificate for a large SASE. Wagon Train mobile on Oct. 16. Endorsement to CVARC, Box 183, Rome GA 30161.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every place of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I need the following equipment: URM-124, TS1325/TRC-75, TS1324/TRC-75 (also need test sets for this), GRM-21, CU-749/TRC-75, and C2848/TRC-75 (also need antenna coupler for this).

I also need the following modules (these are for the R761/ARC-58): AM 1528B/URC, CV465C/URC, SG-179A/URC, and SG-179B/URC.

I also need the following: AT-197/GR (antenna), TT98/FG (Teletype™), MK-731/ARC-51X (maintenance kit), ARC-134 (radio), ARC-54, 618T, PRC-74B, APA-69 (DF group), RT 524/VRC or RT 246/VRC, OA-3633/GRC, PRC-47, R1149/ARC-58(V), C1939/ARC-58, R1051/URR, URC-9, R220/URR or R640/URR, ARM-48 test set, ARM-47 test set, and ARM-11C.

I will pay reasonable costs for any o the above. Thank you.

Leroy Ritt
PO Box 10
St Mary's 504
South Australia
Australi

I have recently moved to West Haven C and would like to join an amateur radi club in the area.

Roger Hoeft KA9EK
35 Claudia Dr. #42
West Haven CT 0651

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

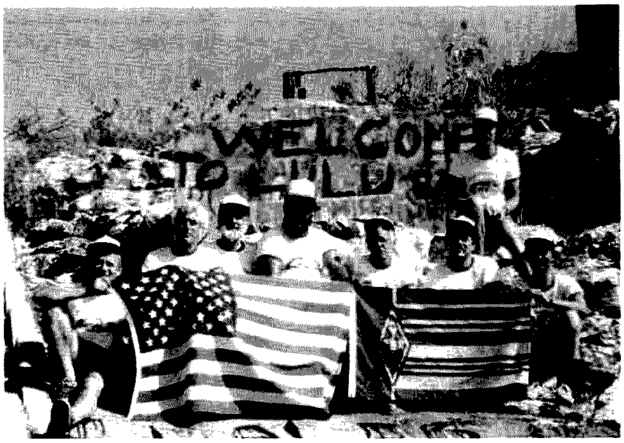
NAVASSA ISLAND KP2A/KP1

An automated lighthouse caps the tiny island of Navassa, a few miles off the coast of Haiti. Navassa meets the sea in an unbroken ring of high cliffs, with no safe harbor or landing site. It lies 15 hours from the nearest assistance by boat and even further from help by any other means. But Navassa's status as a separate "country" under ARRL DXCC rules ensures a continuing flow of DXers to the island.

The latest and most successful such DXpedition invaded Navassa this last March, under the auspices of the International DX Foundation. One member of that trip, Terry Baxter N6CW, related his experiences to me at the International DX Convention in Visalia CA last April. Thanks to Terry for this story.

John Ackley KP2A had often thought of a DXpedition to nearby Navassa. The island is perfect for such a trip: It is within a reasonable boat ride from well-stocked ports; licensing is automatic, as it is part of the United States; the Coast Guard is reasonable about issuing landing permission; and it is a known quantity. In other words, you know exactly what you are getting into, unlike some more disputed DX locations, such as Spratiy. The fact that Navassa did not rank in the top 73 of the most wanted list from *The DX Bulletin* survey (the benchmark of all such listings) was the only drawback to the operation. But increasing interest in DX throughout the world ensured plenty of interest in such a trip. John pressed ahead.

W2IJB climbs the infamous Navassa Ladder while K8CW provided moral support. Imagine hauling all the DXpedition material up this ladder, from a tiny dinghy tossing in the waves!



The KP2A/KP1 crew at Lulu Bay on Navassa. From left: WA2MOE, KP2A, WØDX/VP2VI, KØOO, W2IJB, N2OO, K1MEM; N6CW in back.

He had plenty of help. He had founded the International DX Foundation in 1978 to promote international goodwill through just such DXpeditions. The IDXF would provide major funding for the trip, especially for the equipment. But the trip would still cost almost $10,000. Where would the rest of the money come from? The answer was the same that many other DXpeditions have used: Get more operators and divide the costs among them.

Finding amateurs with the funds, the free time, and the inclination to travel to Navassa was not easy. An early recruit was Bob Denniston WØDX/VP2VI, from the neighboring British Virgin Islands. Bob's illustrious amateur career has included the presidency of the ARRL and the IARU. He also organized the first DXpedition to Clipperton Island in 1954 and is one of the few amateurs ever to return there. He claims two trips to Malpelo as well, including the first radio operation from that rock. Bob presently runs a small hotel on Tortola In the BVI and is active in CW contests and on 160 meters. An amateur of Bob's experience was a great plus in a major DXpedition.

The cast of characters continued to assemble. Hams with DXpedition experience and operating expertise were lined up. A former president of the San Diego DX Club, Terry Baxter N6CW, was a frequent visitor to the British Virgin Islands, especially during the *CQ* WW CW contests, when he would operate as VP2VDH. Terry's eyeball contacts with Bob Denniston eventually led to a spot on the trip.

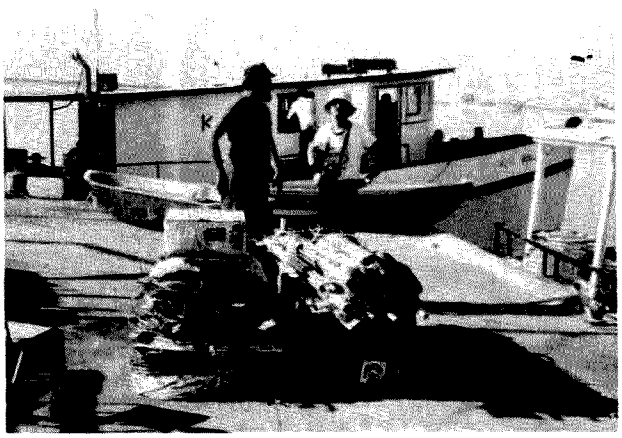
Another member of the team was Ed Magnuson W2IJB. Ed is a Senior Editor of *Time* magazine, and his presence led to a feature article on the DXpedition in the May 3, 1982, issue of *Time*. The other operators were K8CW, N2OO, KØOO, K1MEM, and WA2MOE. The time for the trip was approaching.

During the second week of March, the DXpeditioners made their own way to Kingston, Jamaica, the nearest staging point for the DXpedition. Although Navassa lies far closer to Haiti than to Jamaica, it is much closer to the port of Kingston than to the nearest port in Haiti, Port-au-Prince. And accommodations and supplies are far better in Jamaica.

By Sunday, March 14, all nine members of the operating team were in Jamaica. Dr. John Manley 6Y5MJ provided local support, scouting out a suitable boat and places to stay, and helping with the herculean task of assembling the necessary equipment to send nine operators and six crew members to Navassa. Food, water, gasoline, diesel fuel, barrels, steel pipe for masts, ropes, tents, and more were assembled. One has to anticipate every possible need and stock accordingly. And this list doesn't even include the radio equipment and antennas. When the nearest Radio Shack is days away, the lack of a single coaxial connector can be devastating.

By 6:00 pm on Monday, all the supplies were safely stowed on board the 48' fishing boat

W2IJB and K1MEM in front of one of the operating positions. Note the hill in the background blocking the path to Europe.



KØOO and K1MEM examine a small fraction of the DXpedition equipment and supplies in Kingston, Jamaica, before boarding the boat Gabriella *for Navassa.*

Gabriella and the DXpedition shoved off. For the next 15 hours, the sturdy boat battled the current and trade winds, fighting its way 150 miles east and north toward the low silhouette of Navassa. And all night the amateurs discovered that proficiency at ham radio is no protection from the ills of seasickness. While it may be true that nobody has ever died of *mal de mer*, everyone so stricken certainly wishes he could. An inauspicious beginning to the trip; what would the next day bring?

At dawn, the *Gabriella* was anchored firmly off the Navassa landing site at Lulu Bay. There are exactly two ways to get from the anchorage to the island: the Coast Guard way, via helicopter, or the radio amateur way, via The Ladder. The Coast Guard description of access to the island includes this warning: "There is constant danger of the boat being broached by the incoming swell, being smashed against the cliff, being caught and crusted under the cliff, or being engulfed by the receding backwash." Instead of a landing, a steel and wire ladder hangs 40 feet down to near the water line. "Landing" at Navassa means maneuvering your dinghy under the steel ladder (presumably avoiding the aforementioned dangers) and, catching the 5'-10' swells just right, leaping out of the dinghy to the ladder. Then, an easy climb up two-foot rungs of angle iron to the tiny platform and you're ashore on Navassa.

Multiply this task by nine to get the operators ashore, and then think about moving the tons of equipment and supplies from the boat to the dinghy, under the ladder, and up to the island. Two generators, barrels of gasoline, four complete stations, 3 tribanders, an amplifier, food, water, and tents—all the hardware for a week-long DXpedition had to be shuttled in to the ladder and hauled up to the platform. But even that was not the end of the task. The platform is 50 feet below the nearest flat spot on the island. A set of rough stone steps leads up from the platform to the first, lower plateau. K8CW devised an ingenious cart which rolled up the ramp by the steps, until it failed under the heavy loads. Elbow grease and armstrong power prevailed, and the gear slowly began to accumulate on the lower plateau.

But suddenly *Gabriella*'s warning horn blasted. The hams on the island switched on their HTs to hear the chilling news that a couple of small, open boats had suddenly appeared and two men were climbing the ladder. Were the intruders some of the notorious pirates which frequent these waters? Haitians bent on revenge against the American oppressors? Stu Greene WA2MOE's fractured French soon allayed both fears. The Haitian fishermen had rowed across 40 miles of open water in tiny rowboats looking for better fishing grounds. They would be pleased to help unload the dinghy and haul the hundreds of pounds of remaining equipment up to the operating site in exchange for some food. The deal was quickly struck and the amateurs resumed the task of assembling the actual stations. Even with the help of the fishermen, it took two days to transport all the gear from the *Gabriella* to Navassa.

Meanwhile, KP2A/KP1 struggled to get on the air. Having abandoned the original plan of transporting all the gear to the island first, John and the other amateurs concentrated on the generators and antennas. After all, the food and water could come over any time, but the whole world was waiting for the first QSO. And Tuesday night, KP2A/KP1 did indeed hit the airways, with the first of more than 33,500 QSOs.

The hams set up separate stations along the ledge. The higher frequency bands boasted TH3s on 20' steel poles. Dipoles sufficed for the lower bands, with the 40-meter dipole doubling as a 15-meter antenna during the day. Six meters was a big disappointment, with only 15 QSOs (all South Americans). But 160 meters made up for any lack of propagation on 6. Bob Dennisston strung a dipole across an inlet of the ocean, nearly 100' above the water. He then made 87 separate trips back and forth between the rig and the antenna to properly tune the dipole. His perseverance paid off: KP2A/KP1 logged 522 QSOs on 160!

The other operators manned all the other stations, and averaged more than 4 QSOs per minute of operation! The hill to the northeast blocked European signals somewhat, but CW provided thousands of European contacts. In fact, the 33,000+ QSOs were evenly divided between SSB and CW, with many of the CW QSOs coming from outside the States. Eight percent of the stateside QSOs were on SSB. The six CW operators on Navassa were a fussy lot: Each brought his own keyer and paddle! The keyers and paddles crowded the tiny tables, but a major DXpedition is no time to learn someone else's keyer! The DXpedition avoided lists completely and even managed to work most contacts on frequency, only resorting to split-frequency operation a few times. Band conditions permitted barefoot operation on all but 20 meters in the evening, which helped reduce gasoline consumption to one barrel from the anticipated three.

During infrequent breaks in operating, the hams explored what little of Navassa is worth examining. Graffiti reading turned out to be the biggest thrill of the trip, as Coast Guard regulations prohibit alcoholic beverages on Navassa.

The time came to leave Navassa and the DXpedition crew began the long task of disassembling the gear and shuttling the equipment back to the *Gabriella*. With no major emergencies and more than 33,500 QSOs in the logs, the KP2A/KP1 DXpedition must rank as one of the most successful ever. And months later, the first of tens of thousands of QSL cards hit the mails (QSL via WB2MSH). Thousands of amateurs are indebted to the Navassa operators for "a new one." Let's hope the Heard Island trip meets with equal success.

(I would like to thank *Time* magazine, the International DX Foundation, *The DX Bulletin*, and especially Terry Baxter N6CW for the information in this month's column.)

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR,
4006 Winlee Road
Randallstown MD 21133

Well, with this time of year comes the announcement of what has become an autumn tradition, the SCATS RTTY Art Contest. Mae Washburn WA6LNH, of the Southern Counties (California) Amateur Teleprinter Society, sends along the official announcement of this year's competition, which includes several changes from previous years.

The contest period is from September 1, 1982, to November 30, 1982, and is open to licensed amateurs worldwide. Entries must have been originated by means of *manual* input to a teleprinter using a standard communications keyboard. Sorry, folks, no computer-generated pictures! Either the amateur or an amateur's family member may be the originator. The subject matter must be "suitable for transmission via amateur radio."

Tapes of entries should be five-level, 11/16th-inch-width, run no longer than 40 minutes at 60-wpm speed, and be unspliced. They should be compatible with machines which both do and do not downshift on space. For those of you who are confused by that, it means that if you are sending in uppercase (FIGS) and have to send one or more spaces, follow the space with another FIGS character. Conversely, if you are changing from upper- to lowercase, do not depend on the space to effect the change—send a LETTERS character. Got it?

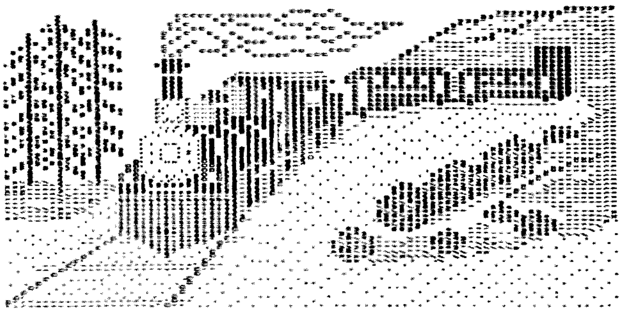
More particulars: No need to worry about BELL and apostrophe problems—they will allow for that. Between you and me, though, I normally send one of each (that is FIGS-J and FIGS-S) to be sure that the apostrophe is printed. A line should terminate with a CAR-RET/LINE FEED/LETTERS sequence, at a minimum. I normally throw in an extra carriage return, though!

Now, an important difference from previous years is the limitation of each line to *68* characters, rather than 72. This is to accommodate some of the European equipment which was unable to display the longer line length.

The artwork must have been transmitted for the first time via amateur radio after September 1, 1982, and have written confirmation received. There are some more particulars, available in the full list of rules available from SCATS. Write to the RTTY Art Contest, c/o Norm Koch K6ZDL, PO Box 1351, Torrance CA 90505.

The winners of the 1981 contest, whose works are reprinted here, include Jean Carter KA6HJK of Buena Park CA, for her entry, "The Railroad." This is Jean's first year as a ham, her first entry in a RTTY Art contest, and she won the first prize! Second place went to Alfred La Vorgna WA2OQJ of Hicksville NY, for "A Prize In Every Box," and third place went to Charles Pike K3YUH of Monica PA, for his comical "What's Up, Doc?" Honorable mention saw a tie between Bent Pederson OZ5RT, of Copenhagen, Denmark, who submitted "The Wild Horse," and Richard Camp WA7NGN of Las Vegas NV, with "Freddy Fender." Why not try your hand this year, and see if your work can grace the pages of *73* next year?

Several club newsletters cross my desk each month, and I would like to take a moment to acknowledge some of them. The Inland Empire RTTY Network, out in San Bernardino CA, puts out a nice mimeographed newsletter which describes their repeater and club functions. A nice map describing coverage areas and linkages of two-meter RTTY repeaters is a welcome addition to the paper. The Stark RTTY Group, in Massillon OH, has thoroughly revised its publication, *Watts Happening*. No longer a few hectographed sheets, it is now an impressive little booklet complete with features and ads. Terry Russ N8ATZ, the editor of the newsletter, has done a fine job and I'm sure the membership will benefit.



First place: Jean Carter KA6HJK.

Second place: Alfred La Vorgna WA2OQJ.

Also in the mail are letters. Oh, boy, are there letters! I am going to try to cut down this backlog over the next few months and put the questions of widest interest here in the column for all to see. This month, Kurt A. Theis WA6YDQ, from Citrus Heights CA, gets the spotlight. Kurt asks several questions which just delight the heart of a columnist like yours truly. I shall respond in order.

Kurt asks, "On the Model 15, under the carriage there are several bars running through a metal plate. On the plate are stamped certain characters, among them "TAB", "STOP", and "LF". Do the TAB and STOP have any use in ham RTTY and, if so, how do I make use of them?" Well, Kurt, the hunk of metal you are looking at is the blocking bail on a function lever. Several of the machine functions you note, most importantly TABulation, are available in specially-equipped machines. However, I know of no ham use for these functions, as they are not supported in the vast number of machines. And since the Teletype® Model 15 is no longer being manufactured, I guess not too many more will be coming out of the showroom so fully equipped.

Next, Kurt inquires, "I have read a couple of books on RTTY and come across a few things that I would like to try if possible. One of them is SELCAL. I would like to set this up in the shack but I don't know if it would be useful. Is SELCAL used very often in RTTY? Would it be better to use a microprocessor in the decoding or to just build a hardware device for it?" Been reading this column, Kurt? No, seriously, SELCAL, or SELective CALling, is a takeoff on a concept that has been bumping around RTTY for forty years. Originally mechanical, with wheels and disks, this was one of the first fronts to give way to digital electronics. These days, selective calling of one form or

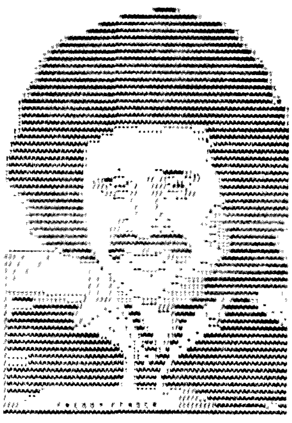
Third place: Charles L. Pike K3YUH.

another is still quite in use, but with far more sophisticated techniques than in years past. For flexibility and ease of use, I don't think there is another way to go. If you want to implement this mode in 1982, then try a microprocessor. You might peruse back issues of *73*. Better yet, ask around the air to get a sense of the diversity of equipment in use.

We can deal with Kurt's third question easily. "Are regenerative repeaters used a lot any more, and are the surplus units lying around any good?" With few exceptions, no.

"Is the BLANK key ever used?" For what, Kurt? Some folks like to idle on the blank, others on the letters. Many tape systems are set up to shut down or disable the keyboard upon receipt of a blank, so it's best not to use it. You would not want to gag the guy you are in QSO with, would you?

Finally, "I have been listening in on some electronic mailboxes and others sending traffic and other personal messages via autostart. If the receiving operator is not there to answer back right away, wouldn't that be a one-way communication that the FCC keeps saying we can't use?" The problem here is not only one-way transmission, although that can be gotten around just as so-called "bulletin stations" have been doing for years, but the non-attended RTTY station. If the receiving station does just that, receive, I don't think you can get too upset. However, if the receiving station automatically takes to the air, unattended, to acknowledge receipt of a message without an operator being present, you are certainly skirting the law. Now, I know that even years ago there were WRU (Who Are You) and Answer Back circuits which did much the same thing, but they weren't any more legal back then. For me, I would feel much more comfortable not enabling a transmitter to answer unless there is a human control operator around to shut things down if something happens.



Honorable mention: Richard Camp WA7VGN.

Honorable mention: Bent Pedersen OZ5RT.

As I write this column, I have been looking around at various eight-inch disk systems (DS-DD) for my computer, a Smoke/GIMIX/6800 system. I am appalled at the dearth of information published or available on the various manufacturers' products. Not only that, but each manufacturer states that his drive is best, and adds how this one tears up media, or fails prematurely, or requires recall modifications to keep going. I don't know how anyone can make an informed choice.

Computer RTTY is leading the mechanical type in the mail by a wide margin, so I shall try to keep the main line where the action is. If you have a topic you wish to see covered in this column, feel free to drop me a line at the above address. I usually answer mail that has a self-addressed stamped envelope—not promptly, but I get there. Other mail is answered in this column only, and then only if it is of general interest. Watch closely: Some reviews of recently released commercial equipment may even find their way in here now and then.

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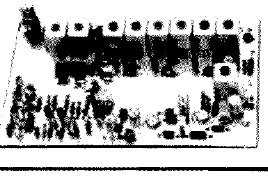

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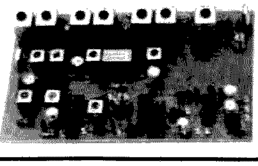

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SATELLITES

SATELLITE QSL BUREAU

One vastly under-utilized resource available to all amateur satellite users is the AMSAT-OSCAR QSL bureau. It works like most such bureaus: Operators keep self-addressed, stamped envelopes on file at the bureau and incoming cards are sorted and periodically mailed out in the envelopes. The only problem, according to bureau manager Bill Luebkemann WB2LCC, is that many satellite buffs aren't currently using the bureau, resulting in a large backlog of unclaimed cards. At midsummer, for instance, the bureau was holding some 1500 unclaimed cards for more than 700 different stations.

To receive cards from the bureau, send Bill up to six self-addressed, stamped #10 envelopes. Foreign stations may send IRCs instead of postage. Your callsign only goes in the upper left-hand corner where the return address would normally appear. Once a month, any cards on file for your station will be mailed using one or more of your envelopes.

Cards to be sent through the bureau should have the callsign of the intended recipient placed on the right rear of each card. The cards should then be put in alphabetical order before being shipped to the bureau. There is a five-cent charge for each card addressed to a station outside North America. All other services of the bureau are free.

For more details about the AMSAT-OSCAR QSL bureau, write to WB2LCC, 116 Country Farms Road, Marlton NJ 08053.

THE UoSAT SAGA

A 150-foot parabolic dish antenna was being used this summer in what appeared to be a last-ditch effort to save the ill-fated University of Surrey amateur satellite. The dish, which provides 42 dB gain at 435 MHz, will be used in an attempt to issue commands to the satellite.

The drastic action was made necessary when a software error caused both the 144- and 435-MHz beacons aboard UoSAT to be commanded on simultaneously. As a result, both command receivers are being desensed by the beacons. It is hoped that the very high erp of the big dish will be sufficient to overcome the desense problem and turn off one of the beacons. An earlier rescue attempt using the 26-dB 2-meter EME array of K1WHS proved unsuccessful despite Dave's considerable effort.

Thanks to the *AMSAT Satellite Report* for this information.—WB8BTH.

Amateur Satellite Reference Orbits

		OSCAR 8		RS-5		RS-6		RS-7		RS-8		
Date		UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	Date
Oct	1	0124	96	0054	261	0000	249	0002	248	0101	261	1
	2	0128	98	0048	261	0144	276	0152	277	0058	262	2
	3	0133	99	0043	261	0128	274	0142	276	0055	263	3
	4	0137	100	0038	261	0113	272	0133	276	0053	264	4
	5	0141	101	0032	261	0058	270	0123	275	0050	265	5
	6	0003	76	0027	262	0042	267	0113	274	0047	266	6
	7	0007	78	0022	262	0027	265	0104	273	0044	266	7
	8	0011	79	0016	262	0011	263	0054	272	0041	267	8
	9	0016	80	0011	262	0155	290	0044	271	0039	268	9
	10	0020	81	0006	262	0139	288	0035	270	0036	269	10
	11	0025	82	0000	262	0124	285	0025	269	0033	270	11
	12	0029	83	0154	293	0108	283	0015	269	0030	270	12
	13	0033	85	0149	293	0053	281	0006	268	0027	271	13
	14	0038	86	0144	293	0038	278	0155	297	0024	272	14
	15	0042	87	0138	293	0022	276	0146	296	0022	273	15
	16	0047	88	0133	293	0007	274	0136	295	0019	274	16
	17	0051	89	0128	294	0150	301	0127	294	0016	275	17
	18	0055	90	0122	294	0135	299	0117	293	0013	275	18
	19	0100	92	0117	294	0119	297	0107	292	0010	276	19
	20	0104	93	0112	294	0104	294	0058	291	0008	277	20
	21	0108	94	0106	294	0049	292	0048	290	0005	278	21
	22	0113	95	0101	295	0033	290	0038	290	0002	279	22
	23	0117	96	0056	295	0018	287	0029	289	0159	309	23
	24	0122	97	0050	295	0002	285	0019	288	0156	310	24
	25	0126	98	0045	295	0146	312	0009	287	0153	311	25
	26	0130	100	0040	295	0130	310	0000	286	0150	312	26
	27	0135	101	0034	296	0115	308	0149	315	0148	313	27
	28	0139	102	0029	296	0100	305	0140	314	0145	314	28
	29	0000	77	0024	296	0044	303	0130	313	0142	314	29
	30	0005	78	0018	296	0029	301	0120	312	0139	315	30
	31	0009	80	0013	296	0013	298	0111	312	0136	316	31
Nov	1	0014	81	0008	296	0157	326	0101	311	0134	317	1
	2	0018	82	0002	297	0141	324	0051	310	0131	318	2
	3	0022	83	0156	327	0126	321	0042	309	0128	318	3
	4	0027	84	0151	327	0111	319	0032	308	0125	319	4
	5	0031	85	0146	327	0055	317	0023	307	0122	320	5
	6	0036	87	0140	327	0040	314	0013	306	0119	321	6
	7	0040	88	0135	328	0024	312	0003	305	0117	322	7
	8	0044	89	0130	328	0009	310	0153	334	0114	323	8
	9	0049	90	0124	328	0152	337	0143	333	0111	323	9
	10	0053	91	0119	328	0137	335	0134	333	0108	324	10
	11	0058	92	0114	328	0122	332	0124	332	0105	325	11
	12	0102	94	0108	329	0106	330	0114	331	0103	326	12
	13	0106	95	0103	329	0051	328	0105	330	0100	327	13
	14	0111	96	0058	329	0035	325	0055	329	0057	327	14

HAM HELP

I need a schematic diagram or any information on where I can obtain a six-meter transceiver and/or a receiver in kit form. Tube or solid-state gear is acceptable. I will pay copying costs and postage.

Karl Mesquita Leite PS7KM
PO Box 385
59000 Natal, RN
Brazil

I need manual/schematics/instructions for the Knight T150 transmitter. I will pay the cost of copying and postage.

J. W. Robertson W5RDI
745 Willow St.
Hurst TX 76053

I am in need of a filter for a Collins R390A receiver. I am interested in a mechanical filter of ±6-kHz bandwidth. Any assistance would be highly appreciated.

Hans Kroeger
Frickestrasse 32
D-2000 Hamburg 20
West Germany

I am in need of hardware/peripheral information on the Wang 2200B computer. I will pay postage/copying costs, but please contact me first to avoid duplication.

Phil Sutherland VK6ZPS
92 Arcadia Dr.
Shoalwater 6169, W.A.
Australia

I need crystals for use in an antique "cat's-whisker"-type radio receiver.

B. Frank Vogel, MD WB5PMU
208 Chief St.
Cherokee IA 51012

Can anyone sell me a Mini-Products HQ-1 mini-quad or a B-24/RK-3 mini-beam? Please write first.

Ash Nallawalla VK3CIT
RAAF Academy
Point Cook, Vic. 3029
Australia

I need manuals and/or schematics for the following:

- •Sierra Electronics model 219B transistor tester
- •TS-323/UR frequency meter
- •OS-37/UPM-45 oscilloscope
- •Heath OP-1 oscilloscope
- •Heath O-12 oscilloscope
- •RCA WR-99A crystal-calibrated marker generator
- •Simpson 383-A capacohmeter
- •Konel KR53VA VHF transceiver

I will pay reasonable costs for copying and postage.

Chuck Gerttula
285 S. Cedar
Toledo OR 97391

I need a schematic for a model SE 9176 Sonex cassette recorder.

Harvey C. Brown WD6DRF
PO Box 32275
San Jose CA 95132

Can anyone help me get started in ham radio?

Mrs. Kathryn Wilson
2 Foundry St.
So. Easton MA 02375

CORRECTIONS

Several errors crept into our two-part "Confessions of a Counter Evolutionary" article. In part I (August, 1982), line 9 of column 3 should read: "connections) and R6//R7."

In part II (September, 1982), the following corrections should be made:

- •On Fig. 12 (page 39), pin 12 of IC26 must be connected to pin 9 of the IC before the common connection goes to pin 10 of IC35.
- •In column 2 on page 42 of the article, line 11 should be changed to read "strobes 1-7, not 2-8."
- •On page 42, column 4, paragraph 3, line 5 should read: "2x1¾-inch Bud 2100)."
- •On Fig. 17 (page 44), eliminate the dashed box around the three 74LS04 chips. (Keep in mind that all three ICs are still 74LS04s.)
- •On page 46, column 1, paragraph 1, line 5, the word "Yet" should be omitted.

Charles E. Martin AB4Y
***73 Magazine* Staff**

In the article "Double Trouble on 50 MHz" (September, 1982), the following corrections should be made:

- •Q6 and Q7 are 2N1566A NPN transistors.
- •The .001-microfarad capacitor should be a *fixed*, not variable, capacitor.

Charles E. Martin AB4Y
***73 Magazine* Staff**

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the Dec. '82 issue must be in our hands by Oct. 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

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J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	14	7	7	7	7	3A	7	14	14A	14A	21
ARGENTINA	21	14	14	7A	7	7	14A	21A	21A	21A	21A	21A
AUSTRALIA	21A	14	14	7B	7B	7B	7B	14B	14	14	21A	21A
CANAL ZONE	21	14	7	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7A	7	7	7	7B	7A	14	21A	21A	21A	14A	14
HAWAII	21A	14	7	7	7	7	7	7	14	21	21A	21A
INDIA	7B	7B	7B	7B	7B	7B	14	21A	14	14	14	7B
JAPAN	14A	14	7B	7B	7B	7B	7	7	7B	7B	14	21A
MEXICO	21	14	7	7	7	7	7	14	21A	21A	21A	21A
PHILIPPINES	14	14	7B	7B	7B	7B	7B	14B	14	14	14	21
PUERTO RICO	14	7A	7	7	7	7	14	21	21A	21A	21	14A
SOUTH AFRICA	14	7A	7	7B	7B	14	21	21A	21A	21A	21A	21
U.S.S.R.	7	7	7	7	7B	7B	14	21A	21A	14	14	7B
WEST COAST	21A	14	7A	7	7	7	7	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	14	7	7	7	7	3A	7	14	14A	14A	21
ARGENTINA	21A	14	14	7A	7	7	14	21	21A	21A	21A	21A
AUSTRALIA	21A	21	14	7B	7B	7B	7B	14B	14	14	21A	21A
CANAL ZONE	21	14	7	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7A	7	7	7	7B	7B	14B	14A	21A	21A	14	14
HAWAII	21A	21	14	7	7	7	7	7	14	21	21A	21A
INDIA	14	14	7B	7B	7B	7B	7B	14B	14	14	14	7B
JAPAN	21A	14	7B	7B	7B	7	7	7	7B	7B	14	21A
MEXICO	14A	14	7	7	7	7	7	14	21	21A	21A	21
PHILIPPINES	21	14	7B	7B	7B	7B	7B	7B	14	14	14	21
PUERTO RICO	21	14	7	7	7	7	14	21	21A	21A	21A	21A
SOUTH AFRICA	14	7A	7	7B	7B	7B	14	21A	21A	21A	21A	21
U.S.S.R.	7	7	7	7	7B	7B	7B	14	21A	14	14	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	14	7	7	7	7	3A	7	7	14	14A	21
ARGENTINA	21A	14	14	7A	7	7	7B	21	21A	21A	21A	21A
AUSTRALIA	21A	21A	14A	14	14B	7B	7B	7B	14	14	21A	21A
CANAL ZONE	21	14	7	7	7	7	7	21	21A	21A	21A	21A
ENGLAND	7	7	7	7	7B	7B	7B	14	21A	21	14	14
HAWAII	21A	21	14A	14	7	7	7	7	14	21	21A	21A
INDIA	14	21	14B	7B	7B	7B	7B	7B	14	14	14	7B
JAPAN	21A	21	14	14B	7B	7	7	7	7	7	14	21A
MEXICO	21A	14	7	7	7	7	7	14	21	21A	21A	21A
PHILIPPINES	21A	14A	14	7B	7B	7B	7B	7	14	14	14	21A
PUERTO RICO	21A	14	7	7	7	7	7	21	21A	21A	21A	21A
SOUTH AFRICA	14	7A	7	7B	7B	7B	7A	14	21A	21A	21A	21
U.S.S.R.	7B	7	7	7	7B	7B	7B	14	14	14	14	7B
EAST COAST	21A	14	7A	7	7	7	7	14	21A	21A	21A	21A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

OCTOBER

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G/G	2 F/G
3 F/G	4 G/G	5 G/G	6 G/G	7 F/G	8 F/G	9 F/F
10 F/F	11 F/F	12 F/G	13 G/G	14 G/G	15 G/G	16 G/G
17 G/G*	18 F/F*	19 P/F**	20 P/F**	21 P/F*	22 F/G	23 F/G
24 F/F* 31 G/G	25 P/F**	26 P/F**	27 F/F	28 G/G	29 G/G	30 G/G

November 1982 $2.49½
Issue #266

73®

Amateur Radio's Technical Journal

A Wayne Green Publication

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Page 22

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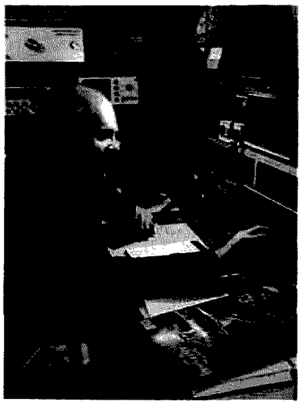
W2NSD/1
NEVER SAY DIE
editorial by Wayne Green



WHERE'S THE SOLDER?

For years, the pride of my workbench was my 300-Watt soldering iron. I looked for it the other day, thinking I might frame it as a historic remnant of a long lost past, and couldn't find it. Well, I don't need that old 300-Watter anymore anyway. These days, a simple pencil iron is enough to do irreparable damage. Some of these damned chips we use today would probably self-destruct if just allowed in the room with the 300-Watt iron. But the fact is that though the tools have changed, we're getting into an era of a high interest in building electronic gadgets.

The recent emphasis on relatively simple building projects in *73* has brought in quite a bit of congratulatory mail. It's appreciated. You know, when I started *73*, back in 1960, one of the basic reasons I felt that the magazine was needed was to encourage hams to build more. As the editor, I'd had one hell of a battle with the publisher of *CQ* over this. He wanted monthly columns, which were a lot cheaper to publish. I'd built the magazine up from a real loser to a big winner with construction...and found myself fired. So I started *73* and got right at it with construction projects.

Just to make sure that you know right off when you look at the table of contents on the cover, we'll put a soldering-iron logo by each project. Mind you, these are not going to be all-band transceivers which could take you a year to build. I'll still leave those for *Ham Radio*, if they stay afloat.

While it may go without saying that I'm hoping you will write up any construction projects you develop, let me make sure that there is no misunderstanding here. If you design something which might be of interest to the rest of *73* readers, I hope you'll write it up. Type the article double-spaced, leave generous margins, get a friend with a good camera to take art-gallery-class photos of your gem...and let's have it.

Sure, it's fun to operate. But I've never gotten so wrapped up in operating that I missed a meal. Now building...many is the time I've started working on a project and found myself looking at the rising sun, having missed dinner, midnight snack, and all those usual buffering pick-me-ups in between. Hell, building something is more fun than coffee ice cream.

And yes, you can go fairly far afield. Sure, we're mostly interested in amateur radio, but that won't stop us from publishing interesting projects which are involved with other aspects of life such as photography, computers, and so on. You'll get my attention the fastest with gadgets which tie computers and amateur radio together. I know as well as you that we have the tools to make incredible changes in communications over the next few years. It's getting time for us to grab those tools and carve out some pioneer territory with high-speed Morse, RTTY, or ASCII...or whatever pleases you.

We have the parts to make incredibly sophisticated repeaters...yet I've seen little to amaze me so far. Let's get cracking...and writing. I'll publish...and pay.

CIRCUITS CIRCUITS CIRCUITS

Some years ago I began reprinting little circuits out of foreign electronics magazines which I thought might interest the more dedicated experimenter. They were presented with very little backup information ...just enough for the experienced builder to put the project together and get it working. We're running that section again and would like to have you send in little circuits for almost anything. You don't have to put together a whole article—just the circuit, the parts values, and a hint of what it will do. Perhaps you've found a circuit from some other (non-ham) magazine which readers might find of value...or from a book. We'll scan the foreign magazines and see what we can find for you. You don't have to draft the circuits. Just sketch them clearly, showing all parts values. If there are any special parts, show what they are and where they can be obtained. The address is Circuits, Editorial Offices, *73 Magazine*, Peterborough NH 03458. By the way, don't forget to include your choice of book from the Radio Bookshop, which we'll send you when your circuit is published.

For that matter, authors of articles on construction projects should remember that *73* is read in over 200 countries and that in most of them parts are darned hard to come by. Thus, if there is any way to do it, try to use commonly available parts...or at least suggest such as replacements if you've used a 1963 transistor in your unit. A builder in Chile will not be happy if you merely specify a Radio Shack part number...give a bit more in details since his Radio Shack may not carry the full line.

One of the main reasons why *73* is so treasured by DX hams is that it runs more construction projects than any other ham magazine in English in the world. We can't come close to the Japanese ham magazine, but then they have about three times as many active hams there as we do, so that's natural. If I could get someone to translate the Japanese construction projects, I could put out a couple

TECHNICAL EDITOR WANTED

The search is on! We're looking for a knowledgeable ham to become Technical Editor of *73 Magazine*. If you enjoy our small-construction-project format and can tell a good circuit from a bummer, then you're a prime candidate.

Duties of the Tech Editor include checking the technical accuracy of articles, working with authors to get the best new manuscripts, making sure *73* publishes timely reviews of the latest ham gear, climbing the tower to repair the 20-meter beam, installing Wayne's new mobile rigs, etc. There is plenty of opportunity for fun, too, working contests from W2NSD, learning about microcomputers, mountaintopping from the drive-up peak just down the road.

Furthermore, Peterborough just happens to be located in one of the most beautiful areas of the country. The quality of life is superb. Sound interesting? If you are a non-smoker, we'd like to hear from you. Resumes should be sent to Jeff DeTray, Wayne Green, Inc., Peterborough NH 03458.

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hundred pages a month of things for you to build.

I've mentioned before that if you have a DX friend you can help him a lot by giving him a subscription to *73*. The magazine gets positively worn out in most countries. A few years ago, when the dollar was weak, they had no problem getting the magazine, but today it's almost prohibitive in many countries. Of course, behind the Iron Curtain they are not permitted to send money for magazine subscriptions, so they have to depend entirely on the friendship of fellow hams who are more fortunate in where they live.

CQ FAILS CODE TEST!

One of our readers in New Mexico sent in an envelope he received from our friends at *CQ*. On the cover is a bunch of Morse code. The reader translated the code for us, chuckling

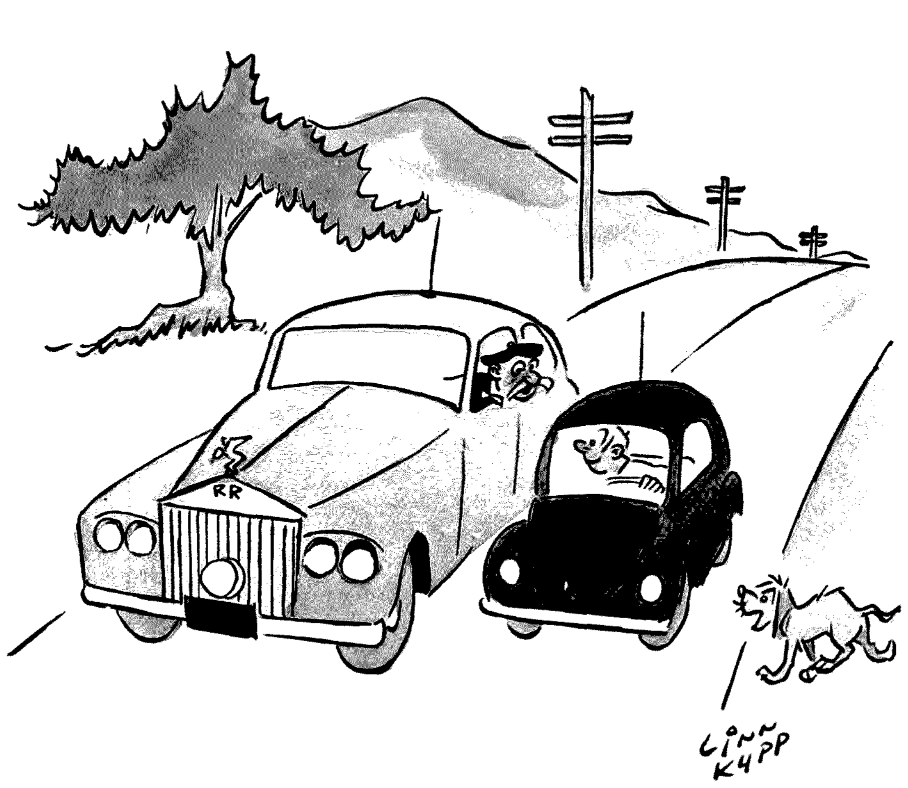
Continued on page 140

QSL OF THE MONTH: AG5X

This month's winning QSL is from Bob Jackson AG5X of Webster TX. Bob has a stunningly simple ultra-modern QSL design. The callsign is presented visually around the upper left-hand perimeter of the card. The callsign is displayed in modern type in the lower right-hand space balancing the image and contributing to the overall pleasing effect of the card.

To enter *73 Magazine*'s QSL of the Month Contest send your QSL in an envelope to: Editorial Offices, *73 Magazine*, Peterborough NH 03458. Specify a book from *73*'s Radio Bookshop (located elsewhere in this magazine). Entries which are not in an envelope or do not select a book will not be considered.

Well . . . I Can Dream, Can't I? by Bandel Linn K4PP



"I'm the guy you were talking to on 2 meters! Please follow me to our yacht landing for dinner!"

Mike Strange WA2BHB
PO Box 58
Pine Hill NJ 08021

A Perfect "10"

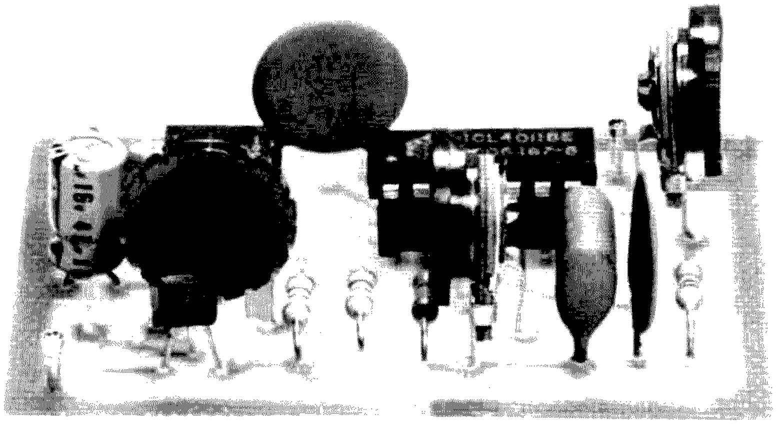
Timer, counter, logic probe—10 functions in all. That's the Multi-Board One, and you can build it.

Ed. Note: WA2BHB's article was one of the honorable mention winners in our Home-Brew Contest. Mike will be receiving a $50 bonus in addition to his normal article payment.

The Multi-Board One (MB-1) started out as a circuit to give a courtesy beep indicating time-out reset on my repeater. A quick prototype showed that with a few extra components, the circuit could be a handy gadget to have in the shack, too. Being a home-brew nut, I'm always needing an extra gated signal source, another trigger, an oscillator, or just one more logic level indicator, etc. I always seem to be one short of whatever it is I need to prototype a new design. Well, the MB-1 was the answer to my problems. It satisfied the two basic requirements to be an addition to my bench: It was cheap, and it did more than one thing (10 in fact!).

The MB-1 as designed is all on one 1¾" × 2½" printed circuit board and can perform the following functions:

- Variable signal generator up to 500 kHz
- Adjustable positive gated astable oscillator
- Adjustable negative gated astable oscillator
- Adjustable positive gated monostable
- Adjustable negative gated monostable
- Adjustable timer with normally off output
- Adjustable timer with normally on output
- TTL/CMOS logic probe, with audible and LED output indicators
- Pulse stretcher
- Repeater beeper



An assembled MB-1. A complete kit of all parts and a G10 reflow soldered printed circuit board is available for $12 postpaid from W-S Engineering Corp., PO Box 58, Pine Hill NJ 08021; telephone (201)-852-0269.

Fig. 1 shows the schematic. It is simple and easy to build. The photo shows a completed unit. Fig. 2 shows the connection/jumper assignments needed to create any of the various MB-1 functions. See Fig. 3 for component layout with jumper hole assignments labeled with letters.

All adjustments for oscillator frequency, pulse length, and output level are on the printed circuit board. You may want to replace the board-mounted trimpots

with multiturn panel-mounted units and the timing capacitor can be mounted with additional capacitors on a rotary wafer switch so you can have several ranges available. The variations are endless and, for a few dollars, you can create a lot of useful test gear for the shack.

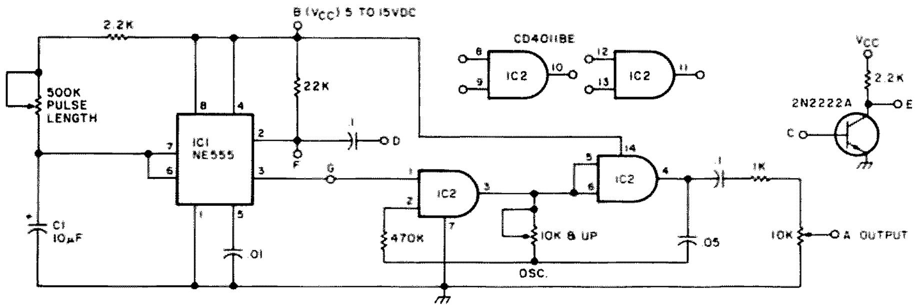


Fig. 1. MB-1 schematic.

Theory of Operation

The Multi-Board One uses a basic RC oscillator with an enable signal being provided by a 555 timer setup in various trigger modes. One half of a 4011 quad NAND gate is set up with a positive enable input at pin 1 driven by the output of the 555 timer. The output of pin 3 of the 555 timer is normally low, so the 4011 oscillator is off. When pin 3 goes high, the oscillator turns on. Pin 2 of the 555 is the trigger input. When a negative-going pulse causes the voltage at this point to drop to below one-third of Vcc, the output of the 555 (pin 3) goes high and the 4011 oscillator turns on. If pin 2 of the 555 is held low (grounded), the oscillator acts as a generator.

The *pulse length* potentiometer controls the duration of the high output of the 555 (pin 3, point F). Anything 10k Ohms or greater can be used. The larger the value of this potentiometer and the larger the value of C1, the longer the "on" dura-

Function	Input	Output	Interconnections
1. Signal Generator	1. None	1. Point A Ac signal, will drive 8-Ohms & up	1. Point F jumpered to ground
2. Beeper and Positive Gated Astable	2. Point C through 22k resistor	2. Point A Pulse of ac	2. Jumper point E to F
3. Beeper and Negative Gated Astable	3. Point D with a negative-going pulse	3. Point A Pulse of ac	3. None
4. Positive Trigger Monostable	4. Same as #2	4. Point G Dc pulse	4. Same as #2
5. Negative Trigger Monostable	5. Same as #3	5. Same as #4	5. None
6. Audible CMOS Logic Probe (See Note #1)	6. Tie points 8 & 9 together. Put a 100k resistor from 8 & 9 to ground. Points 8 & 9 are now the Input.	6. Point A Ac signal to speaker	6. Point 10 to F Connect point B to power source of CMOS circuit being checked.
7. CMOS Logic Probe with LED output	7. Same as #6	7. Same as #6 for audio. For LED, positive LED leg to point G, other leg through 1k to ground	7. Same as #6
8. CMOS Logic Probe with Pulse Stretcher (See Note #2)	8. Same as #6	8. Same as #6 or #7 as desired	8. Same as #6
9. Reverse Logic for #6,7,8	9. Same as #6	9. Same as #6 or #7	9. Point 10 to points 12 & 13. Point 11 to F.

Note #1: Set duration potentiometer to minimum so there is no delay.
Note #2: Set duration potentiometer to position of desired "pulse stretch" length.
All instructions assume ground and power connections are correct.

Fig. 2. Hookup connection function chart.

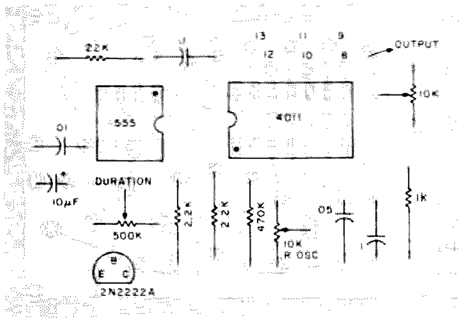


Fig. 3. MB-1 PCB layout, component side.

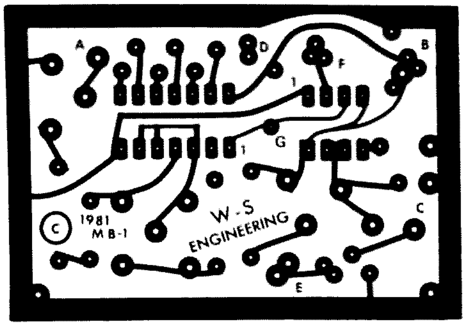


Fig. 4. MB-1 PCB layout, foil view.

tion. Timing can be set from milliseconds to hours. Note that C1 *must* be a high-grade, very-low-leakage electrolytic capacitor. Cheap or surplus capacitors have far too much leakage, and the circuit will not work with them.

The frequency of oscillation is controlled by the potentiometer labeled OSC. This potentiometer can be from several Ohms to megohms. The higher the value, the lower the frequency of oscillation. The output frequency is determined by the .05-uF capacitor and R-OSC. You can get this circuit to work up into the megahertz range, but above 500 kHz, stability becomes a problem for such a simple circuit.

A buffered input is available by using the 2N2222A. It also acts as an inverter.

The output level from the circuit for the astable and oscillator modes is controlled by the 10k-Ohm *output* potentiometer. As designed, the circuit will drive an 8-Ohm or greater speaker. In a reasonably quiet room, you can hear the audio output quite well.

Construction

Building of the circuit is very easy if you use the printed circuit board approach. Fig. 3 shows the pictorial layout of the PCB. Fig. 4 is a foil view of the actual printed circuit layout. Parts are not critical, but if you use cheap parts, the circuit performance is significantly degraded. Since this circuit is so small, it pays to use first-class prime parts.

Checkout and Setup

The fastest way to verify that your MB-1 works is to configure it as a generator. Hook up the board as per Fig. 2, function 1. Fig. 5 shows sample physical configurations, so you can make sure you have everything correct. Set R-OSC at mid-range and R-OUTPUT for maximum audio. After you apply Vcc, you will hear a tone from the speaker. If no output, vary the R-OSC and R-OUTPUT settings. If you still don't hear anything, start checking for bad ICs, incorrect wiring, solder shorts, etc.

Applications for the MB-1

I have found the MB-1 to be the most useful and cheapest little circuit I've designed. I have one in two different testers acting as simulated microphones. Another is used as a CMOS spare logic probe. I particularly like the audible feature so I can hook it to one part of a circuit and not have to look at it to know what is going on. And yet another is being used as a basic 455-kHz signal generator for rough applications. And last but not least, one is the original "beeper" for my Porta-Peater repeater.

You will probably think of more applications for this circuit after you have made a few. Figs. 2 and 5 should get you up and running. After you have put a few of these modules to work, you'll probably wonder how you got along without them!

I'm more than happy to answer any questions or provide any application assistance you may need. However, please provide an SASE. This greatly speeds up the answer process and keeps me from destroying the household budget.

W-S Engineering has a complete kit of all parts including a PCB for $12.00 postpaid in the U.S.A. (W-S Engineering, PO Box 58, Pine Hill NJ 08021). ■

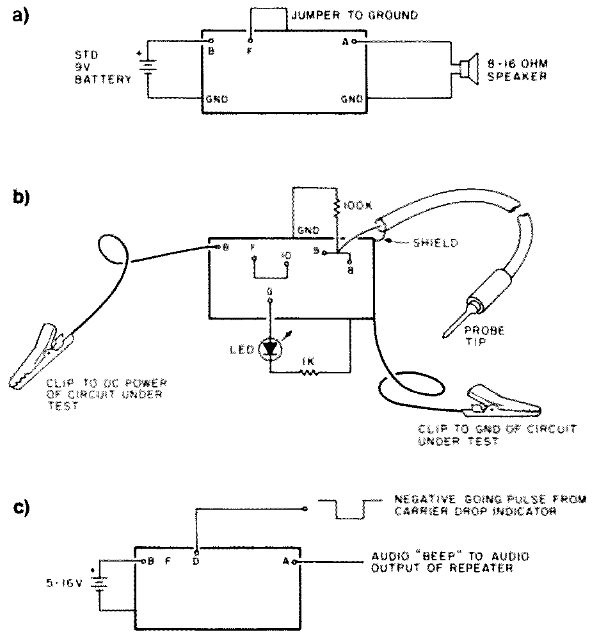


Fig. 5. Sample applications. (a) Hookup for audio signal generator (function #1). (b) CMOS logic probe with LED indicator (function #7). (c) Repeater beeper (indicates timeout reset) with negative pulse trigger (function #3).

Parts List

Bare PCB	8-pin DIP socket
NE555 IC	2N2222A transistor
CD4011BE IC	47-uF, 16 V dc capacitor
10k trimpot (Panasonic Q0A14)	22k, ¼-W resistor
2 500k trimpots (Panasonic Q0A56)	2 2.2k, ¼-W resistors
.01-uF bypass capacitor, 50 V dc	470k, ¼-W resistor
.10-uF capacitor, 50 V dc (2)	1k resistor
.047 metallized polyester capacitor	100k, ¼-W resistor
16-pin DIP socket	T1 ¾ Red LED

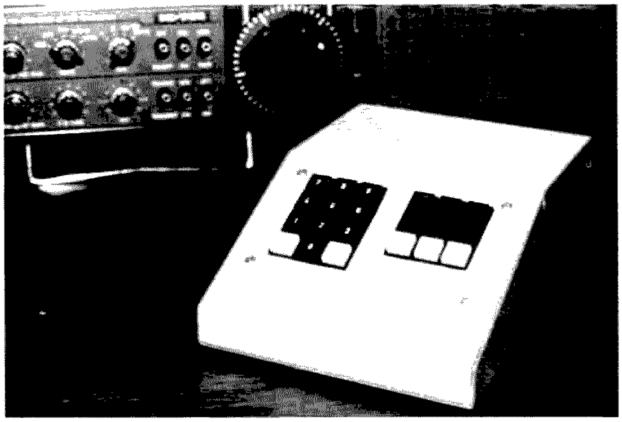
Remote-Control Your IC-701

Simpler than commercial controllers, this home-brew unit nevertheless features push-button band changing and frequency selection, scanning, and expanded coverage.

Glenn Williman N2GW
612 Auth Avenue
Ocean NJ 07712

Soon after purchasing my 701, I became interested in exploring the remote-control capabilities of the radio. I was not willing to spend the money for the manufacturer's unit, but I also did not need many of the built-in features obviously intended for use with their companion 2-meter set, the IC-211. Some cautious experimenting with the accessory connector on the rear panel led to the design of this relatively simple control unit which can perform all the operations I feel are necessary for operation on the HF bands. Basically, this unit can perform the following functions:

- push-button control of bandswitching
- frequency selection
- manual frequency scanning (fast or slow)
- extension of frequency range of standard IC-701

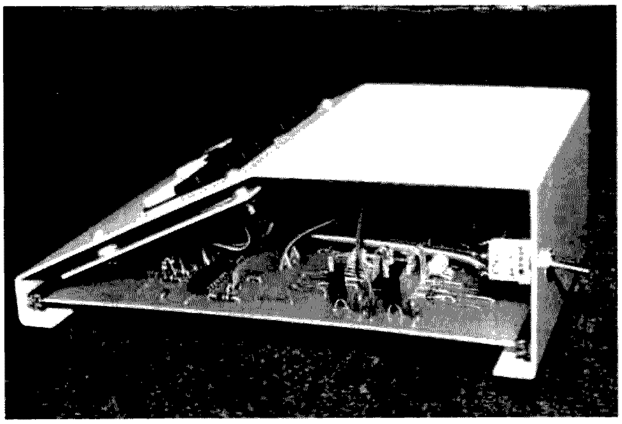


Front view.

Theory of Operation

In order to understand the operation of the remote-control unit, the requirements for controlling the IC-701 must first be examined.

The synthesizer in the IC-701 contains two presettable up-down counters which control the programmable divider in the phase-locked loop (PLL), one counter for each of the two vfo positions selectable on the front panel. The frequency data is encoded and read in serially, and in the normal mode of operation the data contains four characters, i.e., after the serial



Side view.

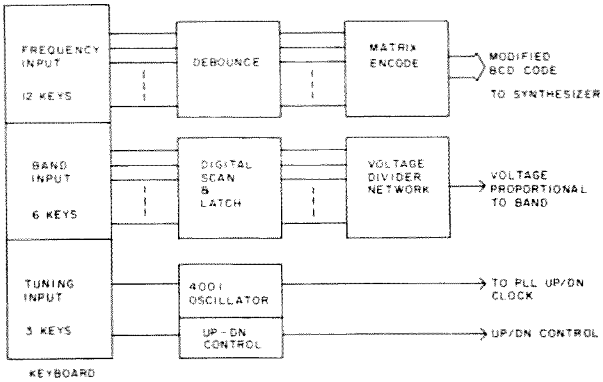


Fig. 1. Block diagram.

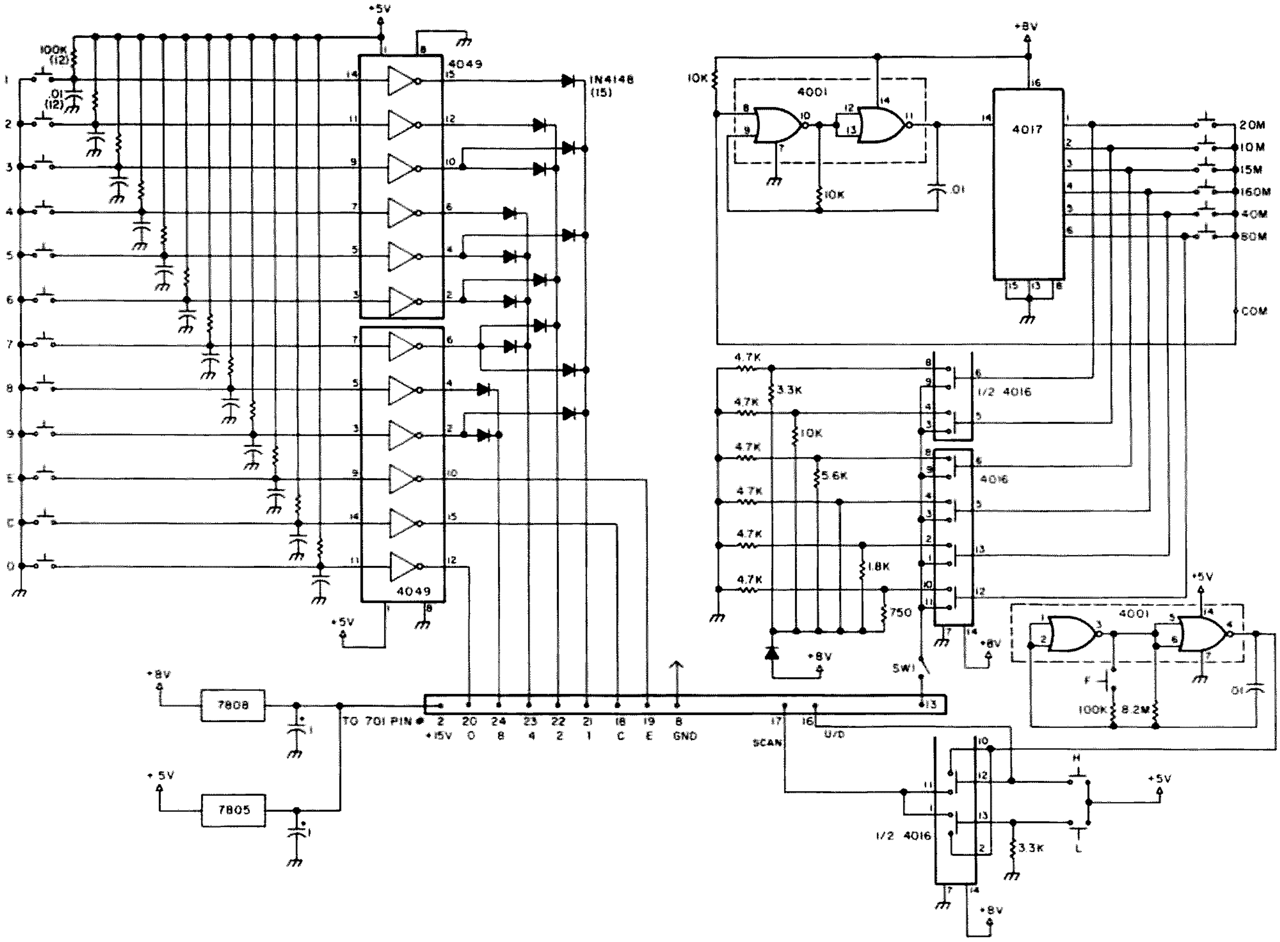


Fig. 2. Remote-control circuit.

data of the first four characters is entered, any succeeding data is ignored until the counters are again cleared.

Automatic bandswitching is accomplished by a stepping relay which is driven by a differential comparator. A front-panel switch selectable tap on a voltage-divider chain is compared to a similar voltage-divider chain switched by the stepping relay. When the two voltages are approximately equal, the relay is de-energized.

Therefore, two types of signals are required: a series of pulses to program the frequency of the synthesizer and an analog voltage proportional to the desired band. Fortunately, access to these signals (and many others) is provided at the accessory plug on the rear panel of the IC-701. The frequency programming inputs are always active and are terminated internally either by resistors to ground or within the PLL LSI unit. The analog voltage input for bandswitching becomes active only when the bandswitch on the front panel of the IC-701 is placed in the external position.

Circuit Description

Knowing the types of signals required and the further requirements which I imposed of using simple push-buttons and CMOS circuitry, the circuit shown in Fig. 2 evolved. A block diagram is shown in Fig. 1.

The frequency information is keyed in by twelve SPST push-button switches which are effectively debounced and encoded with a diode matrix.

As the switch is closed, in Fig. 3, the inverter is pulled to ground and any bounce is damped by the effect of the RC network. When the switch is opened, any bounce is again damped since as long as any of the damped or filtered bounce transients do not exceed $V_{CC}/2$, the switch is effectively debounced at the output of the inverter. For this circuit, 100k and .01 uF provided the necessary time constant for the switches used.

The debounced switches for 0 through 9 are then encoded into a BCD code. The exception is the 0 key. A separate line is used for the 0 character, rather than representing it as the absence of all other lines. This is presumably required since the PLL unit loads

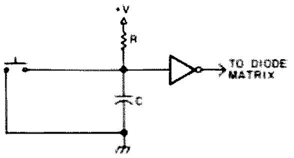


Fig. 3.

data serially one "digit" at a time with each keystroke. The C and E keys are control signals. The C key clears the counters, and the bottom edge of the selected frequency band will be displayed. The E key resets the counters and must always be used prior to entering digit information.

In order to achieve push-button control of the bandswitching, a digital scan and latch circuit is used. A 4001 RC oscillator running at about 4 kHz clocks a counter with decoded outputs (in this case a 4017,

RIBBON CABLE PIN #	IC-701 PIN #
1	2
2	19
5	16
6	17
7	13
8	21
9	22
10	23
11	24
12	8
13	20
14	18

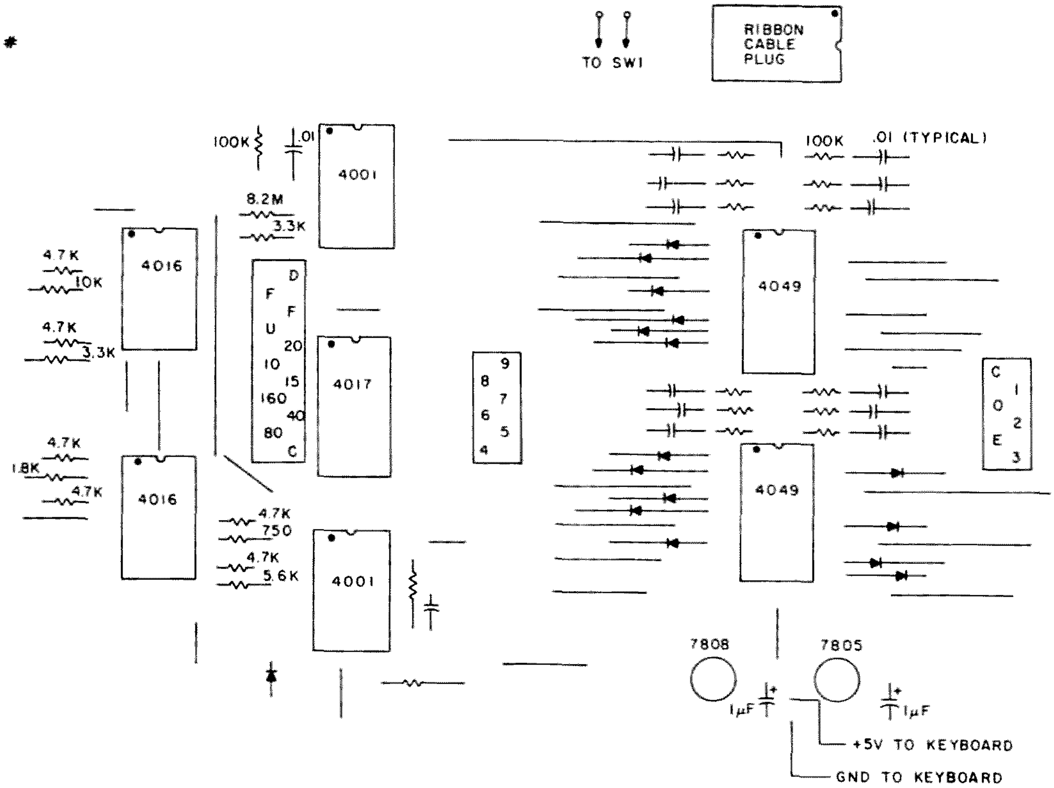


Fig. 4(a). Control circuitry component layout.

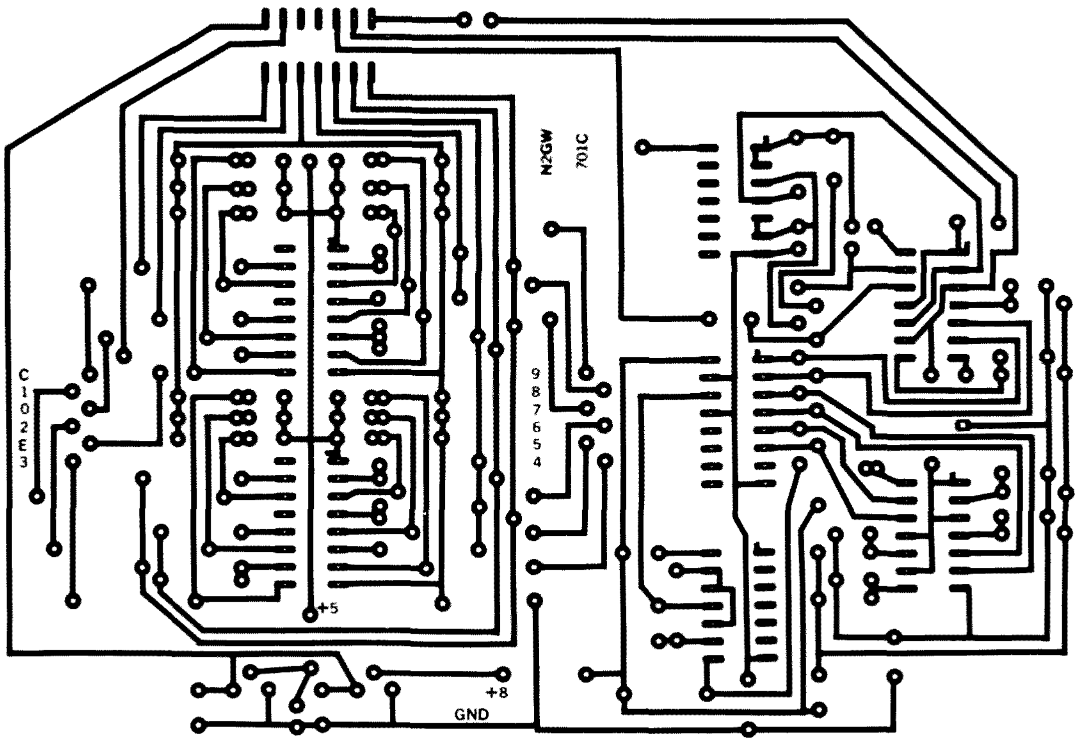


Fig. 4(b). Control circuitry PC board.

since they were available). Assume the counter is stopped in state #1, and the clock is inhibited by the 10k pull-up resistor. Depressing any of the other five keys corresponding to states 2 through 6 pulls down pin 8 of the 4001, since outputs 2 through 6 are low, and enables the clock. The counter cycles until the high decoded output corresponds to the depressed key. Then the clock and counter are again stopped. Essentially what happens is that the selected output line of the counter is latched high by whichever key is momentarily pressed. This selected line also controls one of six bilateral switches (4016s). The input side of the bilateral switch is connected to a voltage divider whose voltage corresponds to a particular band, and the outputs are all common and fed to the band select input of the 701.

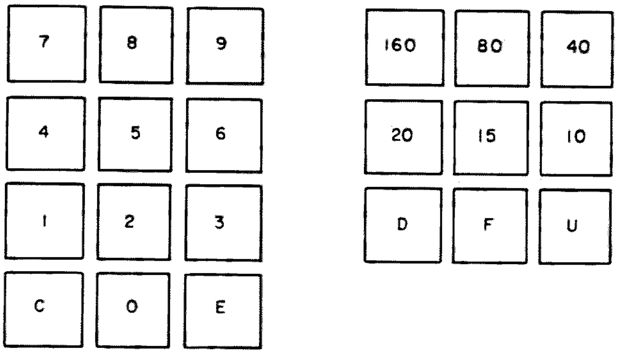


Fig. 5(a). Keyboard component layout.

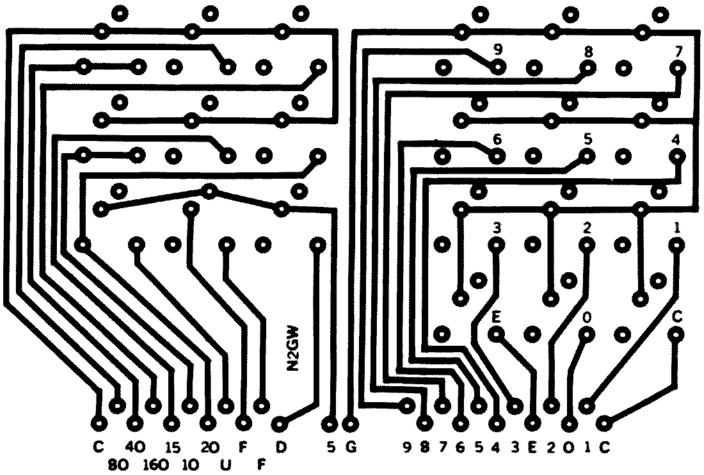


Fig. 5(b). Keyboard PC board.

Another 4001 RC oscillator serves as the scan clock input to the 701 in order to clock the divider in the PLL unit which tunes the synthesizer up or down in frequency. There are two inputs for this on the 701. Clocking one line will increment or decrement the synthesizer depending on an up or down signal on the other line. The RC oscillator is run at both a fast (500-Hz) and slow (10-Hz) rate so that fast and slow tuning can be accomplished. The H key tunes the 701 higher in frequency; the L key tunes lower in frequency, and the F key increases the tuning rate to a fast scan and must be depressed with an H or L key for fast tuning.

Power for the remote control is obtained from the 15-V-dc pin on the 701 accessory plug and is then regulated down to +8 V and +5 V for the different portions of the circuit. The up-down counters (fast and slow) and the frequency preset logic are all standard CMOS in the 701 and run at +5 V dc. The bandswitching voltage dividers in the 701 are fed with regulated +8 V dc, so this must be duplicated in the remote-control unit.

Construction

Two printed circuit boards were designed for this project, although a small IC breadboard will work nicely. One is for the keyboard (3" × 4.5") and one is for the control circuitry (6.75" × 4.5"). These are shown in Figs. 4(b) and 5(b). The push-button switches mount directly on the printed circuit board. Parts placement is shown in Figs. 4(a) and 5(a). The boards mount in an LMB type MDC 752 modular console. Ribbon cable (12-conductor) is used to connect the remote control to the accessory plug for the IC-701.

Operation

The layout of the keyboard with the band-switching and tuning keys on the right side and frequency selection keys on the left side lends itself to easy operation. Typical usage of the remote control goes like this:

1. Change band using one of six band select keys.
2. Enter particular frequency, e.g., 21.320.0, by using the 12 frequency select keys (sequence keyed in this example would be E3200).
3. Tune up or down (fast or slow) using the 3 frequency scanning keys (below band select keys).

Changing from one band to another and moving from one end of the band to the other can be done con-

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siderably faster than by manual tuning, and with no transmitter tuning, the capability for instant QSY becomes more realizable.

There are several interesting operating tricks which can also be accomplished with the remote control.

1. The RIT, once turned on, will not be defeated when tuning with the remote control, as it will with the manual tuning control.

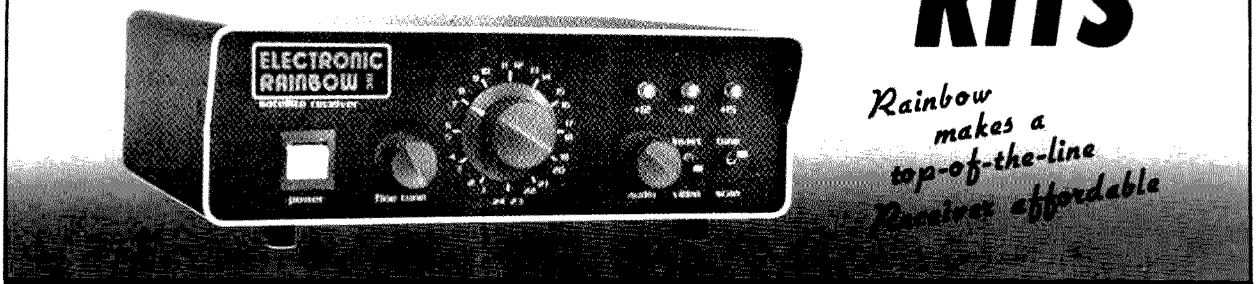
2. Pressing "E" and "1" simultaneously and releasing the "E" first will add 1 MHz to the displayed frequency; however, the display will only change on 20 meters and the display will indicate 15.xxx.x.

The following is a list of the expanded coverage that is available:
160m—1.000.0 to 2.999.9;
80m—3.000.0 to 4.999.9, MHz will not display "4";
40m—7.000.0 to 7.999.9;
20m—14.000.0 to 15.999.9;
15m—21.000.0 to 22.999.9, MHz will not display "22";
10m—no expanded coverage.

There are obviously other features that could be built into the remote control. Memory would be a "nice-to-have" addition and really not that hard to do although the sequential (serial) data input requirement does complicate things somewhat. I don't miss additional memory, over the two in the 701, but then again I didn't miss the remote control until I began using it. The ability to instantly move to different frequencies around the band is the most useful one for me and it has become an operating convenience I wouldn't be without.

Keys for the keyboard and circuit boards are available. Please enclose an SASE for details. ■

SATELLITE TELEVISION RECEIVER KITS



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Automatic Beam Aimer

Here's the scoop on adding set-and-forget convenience to your rotator control. Works with most common control boxes.

Guy Slaughter K9AZG
753 W. Elizabeth Drive
Crown Point IN 46307

I have a smart knob in my shack. It looks like any other dumb old pointer knob sticking out of a black box, but it's really quite clever. Turn it to a given beam heading, and it makes the Cushcraft tribander atop the tower outside my house rotate to that same direction and stop there, all by itself.

I built its prototype originally for my sightless friend, W9PBS, who until then had a problem knowing which way his four-element monobander was aimed. The voltmeter needle on his Ham IV rotator control that usually reads out the direction his beam is pointing is worthless to him, of course. It was while mulling over the problem of converting that analog needle's silent message into something more useful that I came up with the idea for the smart knob. And I liked it so well while debugging it and burning it in on my own operating table that I had to build one for myself.

That's because my own DC-45 rotator control, identical with the Ham IV's and the control for the CDE's big antenna whirler, the Tailtwister, requires holding down both a brake release and a direction button while the beam is swinging from one compass point to another. This can take as much as half a minute for a 180-degree direction change. The smart knob, on the other hand, requires only a quick twirl to the desired beam heading and it does the rest itself, bringing the antenna around to the target while I tweak my transceiver tuning to peak that rare call up out of the mud and prepare to enter it in my log.

If you have a CDE rotator, I think you'd enjoy a smart knob, too. Mine's been in use for many months now without ever rebelling at its task. So has the one in daily use by W9PBS, who actually switches it between two separate Ham IVs, driving 15- and 20-meter monobanders mounted on separate towers.

The knob itself is fastened to the shaft of a 25k pot extending from a black box which, along with all the other parts and pieces inside except those scrounged from my junk collection, was bought at my neighborhood Radio Shack, for a total of less than \$50. The heart of the gadgetry inside the box is that pot and a 12-volt-dc power supply capable of providing 150 mA or so (see Fig. 1). The supply feeds two sections of an LM339 quad comparator chip, three 2N3904 transistors, and three 12-volt relays with DPDT contacts rated at three Amps. (See Radio Shack numbers in the Parts List.) But before we get into their functions, let's discuss the CDE rotator control system.

It is a conventional low-voltage ac capacitor-start motor whose direction of rotation depends on which half of its winding pair is energized. Though the light-duty CD-45, the medium-duty Ham IV, and the heavy-duty Tailtwister rotators have different braking systems and varying numbers of ball bearings in their innards, they are similar electrically and their control boxes are identical. Each contains the motor-feed transformer, the start capacitor, three push-and-hold button switches for brake release and directional control, and the direction-indicating circuitry. That circuitry consists of a power supply which provides 13 volts dc, a voltmeter to read it, and a calibration pot.

Inside the motor housing there is a variable resistor shunted across the floating-ground, 13-volt supply (and connected to it by rotor cable terminal posts 3 and 4 on the back panel of the control box). The movable arm of that remote resistor, mechanically linked to the motor rotor, is chassis-ground, cabled to terminal post 1 on the control unit.

The resistor is tied into the direction-indicating voltmeter circuit so that the meter reads full scale—13 volts—when the rotor is fully clockwise, zero volts at full counterclockwise, and 6½ volts at the halfway

point. The voltmeter face is calibrated accordingly, north at half scale, south at full clockwise and full counterclockwise, with the other points of the compass in between.

And that's where the smart knob comes in. If we connect the outside terminals of its 25k pot across binding posts 3 and 7 on the rear apron of the control box (shunting the rotor-feed wires already there), the pot will be in parallel with the 13-volt, direction-indicator supply, and the pot's center terminal will show a voltage to ground proportional to the difference in relative settings of the pot and the rotor-mounted resistor.

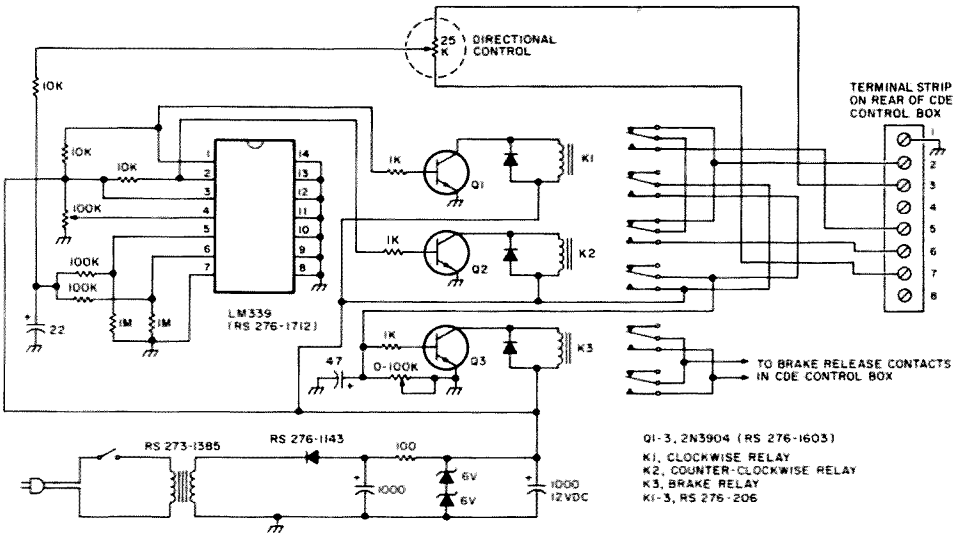

Fig. 1. Rotator control schematic.

With the rotor turned due north so that 6½ volts appears on the voltmeter, turning the smart knob's pot to half rotation—map north as indicated by the pointer knob, straight up—will bring to zero the voltage between its center terminal and chassis ground. Now rotate the pot clockwise, and that zero voltage will climb toward plus 6½, depending upon the degree of rotation. Turn it counterclockwise, and the voltage will fall back to zero at the midsetting, then begin a negative climb to −6½ when it's at full counterclockwise.

That's the secret of the smart knob's intelligence. All we need to do now is harness this intelligence to control the rotor motor and braking circuit so that our beam points wherever the knob tells it to.

Fig. 1 shows how the center terminal of the 25k linear-taper pot feeds two sections of the comparator chip so that one senses positive voltages, the other negative. Because each turns on a switching transistor whose collector current flows through relay coils, one or the other relay is pulled in whenever there is a difference in rotation angle between the smart knob and the beam rotor.

The relay contacts parallel the push-button switches of the rotor control box, thus energizing the brake and rotor motor, which swings the antenna to the direction called for by the smart knob; then the contacts open to hold it there. They are so interconnected that even a component failure or human error cannot trigger simultaneous clockwise and counterclockwise rotation. And there is a time-delay circuit in the brake-release relay's switching-transistor circuitry ensuring that the rotor—and the heavy load it carries—coasts to a stop before the brake is reapplied, thus averting the tower-twisting, rotor-ruining torque that the inertia of a suddenly-braked antenna can exert.

Parts List

1 cabinet (270-453)
1 transformer, 12 V, 300 mA (273-1385)
3 relays, 12 V, DPDT (276-206)
1 on-off switch (275-612)
1 package (2) zener diodes, 6 V (276-571)
1 25k pot, linear taper (271-1715)
2 100k minipots (271-220)
1 package (15) 2N3904 transistors (276-1603)
1 quad comparator LM339 (276-1712)
1 14-pin dip socket (276-1999)
2 1,000-μF electrolytics (272-957)
1 47-μF electrolytic (272-1027)
1 22-μF electrolytic (272-1026)
1 3-Amp rectifier diode (276-1143)
1 PC board, 4½" × 6" (276-1394)
1 package push-in terminals (270-1394)
1 package (50) diodes (276-1620)
3 10k, ¼-Watt fixed resistors
2 100k, ¼-Watt fixed resistors
2 1 meg, ¼-Watt fixed resistors
4 1k, ¼-Watt fixed resistors
1 length, (two, three feet) eight-conductor cable*
1 knob, pointer, junk-box type

*If you've got a rotator, you must have some cable somewhere, probably hanging in the garage. My Radio Shack doesn't stock it. The other parts will add up to around $45, if you buy them all new. Happy knobbing.

The component values shown provide a variable braking delay of about two to five seconds, adequate for my tribander and the heavier four-element monobanders used by W9PBS.

There is one small limitation. Because the voltage signalling the counterclockwise comparator to turn on its switching transistor falls to zero when antenna rotation approaches full counterclockwise south, and because even a smart knob requires a small fraction of a volt to sense, counterclockwise rotation will stop about 5 degrees from due south. But that's no big deal. Most beams have 60-degree lobes; you still can nudge the antenna the rest of the way with the manual push-buttons, or you can tell the smart knob to go full south clockwise where it has lots of voltage to sense. And it will.

There are no particular construction hints to pass along. Everything is dc and, therefore, lead lengths and dress are not a problem. I used perfboard and wired point-to-point because I'm not into printed-circuit fabrication. On one of the

smart knobs that I built, I used an eight-terminal barrier strip to wire it to the CDE control box, and on others I chassis-mounted six-contact female sockets so they could be unplugged from the rotor control box for testing and fiddling.

However you wire yours to the CDE control, there is a small bit of surgery required: You need to shunt a two-conductor cable across the brake-switch contacts inside the CDE control box and bring it out to the smart knob box. There is plenty of room to work inside the rotor control, and the plastic cabinet can be flexed enough to pass the cable between it and the chassis if you don't want to drill it for a connector socket.

If you use a plug and socket for this, be sure the brake contacts are connected to the female half of the connector, because the brake wires are hot with 120 V ac.

With the smart knob built and connected to the CDE control box, disconnect the brake-energizing cable so that the antenna won't be swinging back and forth as you adjust the pick-up-dropout points of the switching transistors by tweaking the 100k minipot feeding pin 4 of the comparator chip. Once you have that minipot properly set so that the device neither hunts for a null nor fails to respond to a 3-to-5-degree rotation of the smart knob, you can loosen the pointer-knob set screw on the 25k pot shaft to line it up at due north when the antenna is pointing due north.

Having thus compensated for any discrepancy between zero voltage at the pot's wiping contact and its precise half-resistance setting, you will find calibration is remarkably accurate at all points of the compass. ■

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For the first couple of weeks after you buy your 2-meter handie-talkie "brick" (Tempo, Icom, Yaesu, etc.), it is sort of fun to plug and unplug the unregulated charger so that the nicad battery pack stays at full charge. After that, though, the newness wears off and it is just a pain in the lower backside to try to guess at how long you ought to leave the juice on before you boil the cells dry. Not only that, but you are never really sure whether you have given the battery pack full charge or whether you are consistently undercharging the nicad pack, a notorious cause of nicad deterioration.

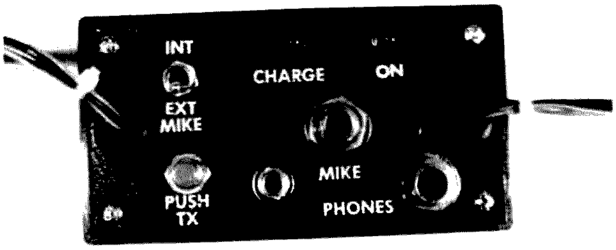
In addition, it would be sort of nice to be able to operate mobile with your brick and use the same mobile speaker and microphone that you use for all your other mobile equipment plus the mobile's battery-generator charging system. The brick box described here will solve these problems and perform the following functions:

1) Regulates the voltage and limits the current from the factory-supplied wall charger so that the nicad batteries in the brick may be left on charge for as long as you like without overcharging.

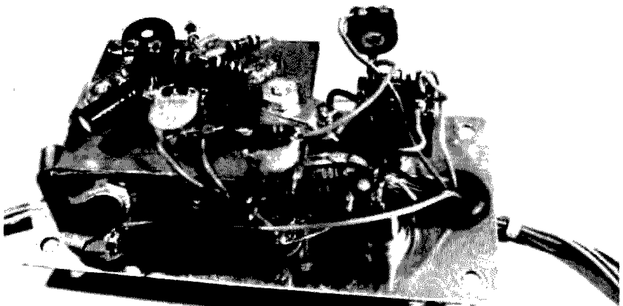
2) Allows the car (or boat, or snowmobile, or aircraft) battery-charging system also to charge the brick batteries with a regulated, current-limited circuit.

3) Permits you to plug in a mobile microphone and provides an amplifier-matching circuit between microphone and brick that is adjustable for exactly the right amount of deviation.

4) Allows the speaker amplifier in the brick to drive an



The completed brick box.



Inside view of the brick box showing unique "cobweb" construction.

external mobile speaker (with an option to install a speaker-driver-amplifier for higher power output) or a set of high- or low-impedance headphones.

5) Permits you to plug in to an already-existing mobile installation such as a private aircraft audio panel or a VHF-FM boat system and use the microphone/speaker/headphone setup in the mobile craft.

6) All these goodies cost less than $10 (plus an extra $5 for the high-power speaker amp).

Here are the ground rules for using this article: Most of the parts are available from any well-stocked ham store or "hobby-shop" electronics place. You may freely substitute for any of the parts. None of the parts values is really critical—a variation of ±20% should never really be noticed. Also, this article was written using the Tempo S1, and interfacing with standard commercial FM microphones and aircraft microphone-headsets (carbon or amplified dynamic). Other rigs and other microphones may require modifications of the mike amplifier circuit as shown later.

Regulator

The power supply regulator must perform two functions. First, on a deeply-discharged nicad battery pack, the regulator must limit the charging current below approximately 200 mA. Limiting the charging current in this manner prevents the cells from outgassing and drying out the electrolyte. Second, the charger must limit the end-charge voltage to the cells to approximately 1.37 volts for each cell, at which point the cells may be allowed to trickle-charge at this voltage indefinitely.

The current limiting may be done by either of two methods. First, if the wall charger itself is one of the "12-V, 50-mA" variety, no external limiting will be necessary. The wall charger itself provides the necessary current protection by its design. However, a fully-discharged 450-mAh battery will require over 9 hours to fully recharge, so you may wish to consider the alternative fast-charge circuit described a little later.

For those using a current-limited wall-pack charger, the circuit shown in Fig. 1 will regulate the final trickle charge voltage to 1.37 volts per cell, or an output of 11.6 volts into the Tempo S1 CHG jack. (1.37 × 8 cells + 0.7 volts, to compensate for one silicon diode inside the S1 in series with the charger line.) The basic circuit uses a 7805 (or 78M05 or 78L05) regulator, with a 1k variable resistor used to set the exact output voltage. To set the output voltage accurately, connect a 470-Ohm resistor across the 11.6-volt regulated output and adjust R1 (the 1k variable) for exactly 11.6 volts on an accurate voltmeter across the 470-Ohm resistor. The value of C1 (1000 μF) is not critical at all, providing that there is less than 150 mV ripple on the output with the 470-Ohm resistor attached. Up to a point, adding more capacitance to this point increases the charge rate (milliamperes) of the wall charger. I found 1000 μF to be the optimum value; do not go below 0.1 μF or the regulator will become unstable.

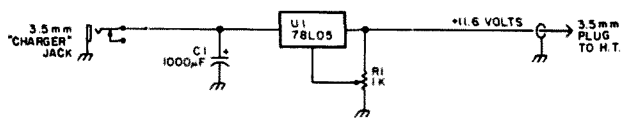


Fig. 1. The basic brick-box charger-regulator.

High-Power Regulator

In the event you can get your hands on a wall power pack with more output or for those who are going to use the almost unlimited current available from an automotive (or boat, or aircraft, etc.) supply to recharge the brick batteries, some method of current limiting must be employed to ensure that the nicad battery pack does not overheat due to excess charging current. Incidentally, for those of you looking for a very inexpensive high-current 12-volt wall-pack-style charger, look in the auto-supply stores or the automotive department of the larger discount houses for a "cold-weather battery maintenance charger." These little rascals *look* just like a low-power calculator wall pack, with one end terminated in a cigar lighter plug, but the fact of the matter is that they put out 12 volts at a whopping 300 mA. Don't forget the 1000-μF filter capacitor, though, because these high-power wall packs have a pretty raw, rectified ac waveform.

The trick to use to keep the maximum available current below 200 mA is to use a 78L05 for the regulator called out above. The 78X05 is actually a whole family of regulators where X defines the normal maximum current available. If X = L (78L05), normal current maximum is 100 mA; if X = M (78M05), normal current maximum is 500 mA; and if X = nothing (7805), the current available is 1 Amp.

Now, the internal current-limiting circuit in these ICs sets the current-limit point to about 150% of the maximum normal current, so if you use a 78L05 as your voltage regulator IC, the maximum current that your nicad pack can draw is approximately 150 mA, well within the maximum charge capacity of your brick's nicad pack.

Since I had planned to use the brick box in aeronautical mobile use in addition to use with a high-power wall-pack charger, not only did I use the 78L05 as my regulator, but I also supplied both a 3.5-mm jack on the brick box to plug-in the

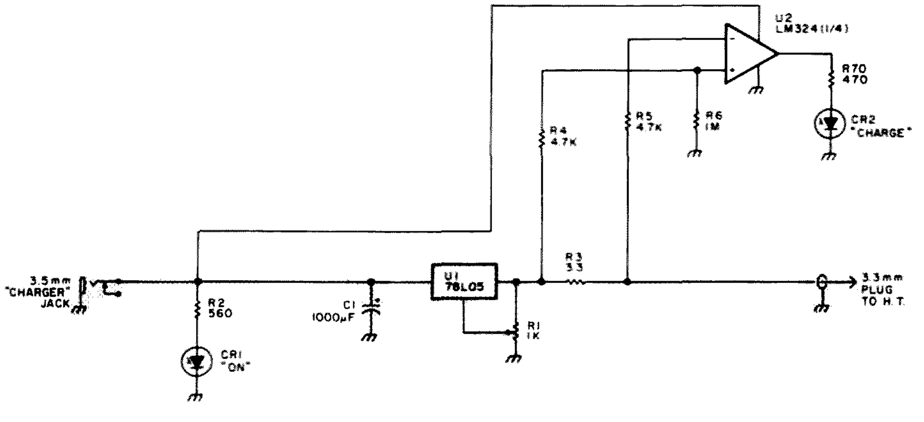


Fig. 2. Adding charge-indicator circuitry.

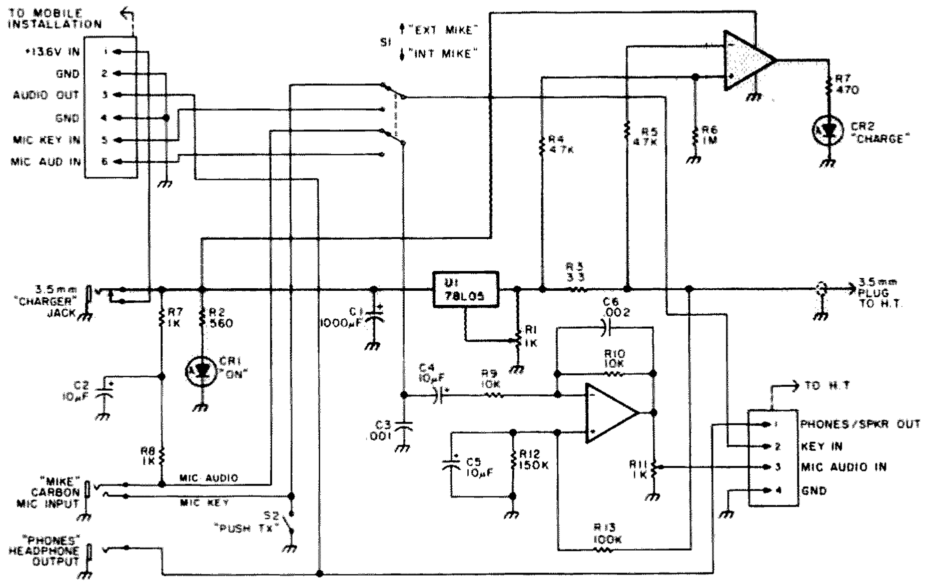


Fig. 3. The deluxe mobile-base brick-box schematic.

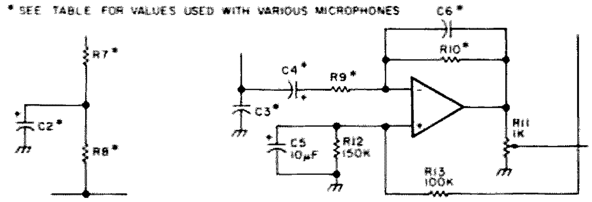


Fig. 4. Parts changes for various microphone types. See Table 1 for values.

wall pack charger and a cable connection to a molex®-type connector for attachment to the aircraft electrical system. As we shall see, using a 6-pin molex connector allows me to use the mobile microphone and speaker/phones, as well as the aircraft battery-charging system.

Charge Indicators

So far, we have a nicad battery pack charging system that will accept a low- or high-power wall pack or a battery-generator automotive-type system. The first refinement to make will be a pair of LED lamps. One of the lamps will tell us when power is being supplied into the charger and the second lamp will tell us when the end-of-charge cycle of the nicad pack has occurred. The first lamp is easy: an LED and a resistor (R2) will tell us if our wall pack or auto system is plugged in. The second (end-of-charge) lamp requires a little more circuitry.

The heart of the charge lamp is a high-gain op amp (LM324) used as a comparator. This circuit is shown in Fig. 2. The type of op amp is not critical, either. The common 741 or any other *true* op amp may be substituted. The so-called Norton (LM3900/MC3401) op amps may be used, but you are on your own for the circuit modifications which are necessary.

The 3.3-Ohm resistor (R3) introduces a negligible voltage loss to the charging circuit, yet drops more than enough millivolts for the op amp to work with. The presumption is that when the charge current drops below 20 mA, the nicad pack is fully charged. At this current, the 3.3-Ohm resistor drops about 70 mV. The op amp senses this voltage drop and when the voltage drops below 70 mV, the charge light extinguishes. R6 (1 Meg) sets the current level at which the charge light turns on and off; if you wish for the light to turn on and off at another current level, attach a resistive load of your chosen value from output to ground and select R6 until the light just flickers. Remember, now, when this lamp is *lit*, the nicads are *charging* and when it is *dark*, the nicads are either *disconnected* or *fully charged.*

Microphone Amplifier

The second refinement is a matching circuit shown in Fig. 3 which will take the output of a standard mobile microphone (carbon or amplified dynamic) and massage it to fit the input requirements of the brick. (Note: for those of you using straight low-z or high-z dynamic, ceramic, or crystal microphones, see Fig. 4. The various values for Fig. 4 are shown in Table 1.) Since the requirements of the brick are a microphone voltage of some 200 millivolts peak-to-peak and the output of the carbon/dynamic microphone biased with 10 mA (by R7/R8) is about 500 millivolts p-p, the op amp circuit shown will provide an output somewhat in excess of requirements and can be adjusted to the proper deviation level with R11. The rationale here was not so much that we *had* to have an op amp to drop a 500-mV level to 200 mV, which could well have been done with a simple resistive network, but we had one leftover op amp from the IC used in the charge-light circuit, and the op amp is necessary for the alternate mike circuits shown in Fig. 4.

Once again, since this brick box was intended for use as both a base-station patch box and a mobile interface unit, a microphone jack was installed on the brick-box chassis, plus a pair of wires to the molex connector for attachment to the aircraft microphone and PTT switch. A switch was included on the brick box so that either internal microphone (the brick-box jack) or external microphone (through the molex plug to the mobile mike setup) could be selected. This was done so that the

Microphone	C2	C3	C4	C6	R7	R8	R9	R10
Carbon	10 μF	0.001 μF	10 μF	0.002 μF	1k	1k	10k	10k
Crystal/Ceramic	Open	10 pF	.005 μF	20 pF	Open	Open	1 meg	1 meg
Low-Z Dynamic	Open	0.001 μF	10 μF	220 pF	Open	Open	10k	100k

Table 1. Values for various microphone types.

pilot of the aircraft (WB6BHI) or the back-seat passenger (WD6EWI) could access the 2-meter rig separately and independently.

The remainder of the elementary brick box is quite simple. The speaker output of the transceiver is run to both the headphone jack in the brick box and a wire to the molex plug for external mobile speaker.

Speaker Amplifier

Although this concludes the construction of the elementary brick box, several comments from my fellow hams led to the first major modification of the box. Since my major application of the box was for airborne use and I was feeding the puny 1/2-Watt speaker signal out of the brick into a 10-Watt airborne cabin speaker amp, I never noticed how poor the speaker audio really was. A few tests convinced me that a speaker amp of some sort was in order. Since the most common high-power chip in general use and availability today is the LM383, I chose to use this fine device. Although the design is very straightforward, I recommend that you heat-sink this device to the biggest piece of metal you can find. In fact, if I were going to include this circuit in my own brick box, I would undoubtedly use the metal chassis cover for the heat sink. The tried and proven circuit of the speaker amp is shown in Fig. 5.

Conclusion

The brick box has been in operation for almost a year now with no serious problems. My S1's batteries have always given me the expected service when charged by the box and mobile service has been beyond any hopes I ever had. (*You* get up to ten thousand feet and call CQ on .52 simplex!) My thanks to WD6EWI for his comments and criticism and N6AUB for his patient on-the-air testing. My additional thanks to the hundreds of hams between Grass Valley, California, and Oshkosh, Wisconsin, who gave us hints and suggestions for improvement during our recent aeronautical mobile cross-country. ■

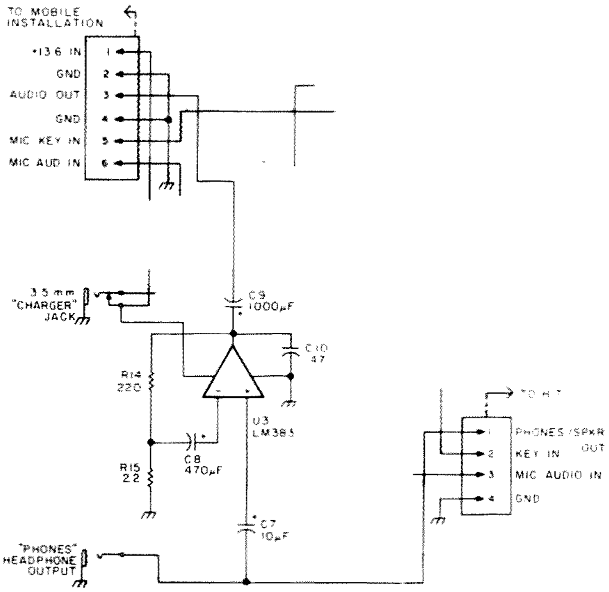


Fig. 5. Adding a high-power speaker amplifier.

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11302	14	.66	.59	.54
11303	16	.72	.64	.58
11304	18	.82	.73	.66
11305	20	1.11	.99	.90
11306	22	1.26	1.12	1.02
11307	24	1.41	1.25	1.14
11308	28	1.71	1.52	1.38
11309	40	2.31	2.05	1.86

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11202	14	.18	.15	.14
11203	16	.21	.18	.16
11204	18	.24	.21	.19
11205	20	.27	.24	.21
11206	22	.30	.26	.23
11207	24	.33	.30	.25
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13834	CL3812	4.0-7.0	15±0.7	100	.85x1.2x1.77	59.95
13835	CL3804	4.0-7.0	28±1.4	50	.85x1.2x1.77	59.95
13836	CL3814	4.0-7.0	28±1.4	50	.85x1.2x1.77	59.95

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13804	SOLV15-15	15	1.2A	4.7-16x4x2	Fixed included	39.95
13806	SOLV15-24	24	0.75A	4.7-16x4x2	Fixed included	39.95
13808	SOLV30-5	5	6.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13809	SOLV30-12	12	4.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13810	SOLV30-15	15	3.3A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
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What?! Another Audio Filter Project?

Yup. And even the most modern receivers benefit from this QRM-crusher.

I got my hands on one of those toy transceivers a few months ago—the kind with a flea-power transmitter and a direct-conversion receiver—and for a while, I had a ball with it.

But slowly, some drawbacks began to manifest themselves—not so much in the rig, but inside my head, where ringing noises refused to go away. The receiver is quite sensitive and has a tremendous dynamic range but it has no agc (automatic gain control), so when you're tuning for weak DX signals and come across a Texas rock crusher . . . Well, I generally don't cherish corona flickering between my ears.

It slowly dawned on me that even my main station receiver, though it has a good agc system for CW, exhibits some other rather nasty habits which it shares with the little plaything receiver. And eventually, I began to think about doing something about it.

Unfortunately, most modern ham-band receivers—even the very good ones—do very little after extracting audio from the product detector, except to amplify it and cram it into a speaker or a headphone output. Many things can be done to audio to make communications a lot better, especially on CW.

The audio unit to be described is my second major effort in that direction. The previous unit, built about 1960, used vacuum tubes and weighed enough to keep my house and shack from blowing away in Hurricane Donna. That unit, described in a long article in *QST*,[1] offered peak clipping, audio selectivity, and volume compression, none of which was available in the receivers of that day—or in most 1981 models. There is one big difference. Modern receivers usually (but not always) have agc systems which work well with SSB and CW.

My new audio processor would have to be all solid state, like the rest of my equipment, and it would have to offer the same features as the original, with suitable improvements.

If you work contests or DX pileups on CW, you know that a 400-Hz passband sounds like you're listening to all outdoors, especially if you have experienced the good selectivity of the 100-Hz-and-under variety.

But selectivity has its trade-offs. Any sort of noise impulse is stretched. Key clicks, which sound like a small-arms fight in some Middle Eastern desert, become a rolling artillery barrage when they're stretched through a sharp filter. So, even with a good receiver agc, you still need to do something about the noise pulses before you introduce selectivity.

And, for those receivers without agc or only a poor agc, audio compression works wonders. Before good agc was developed for SSB and CW, a CW operator had to tune his receiver with one hand on the dial and the other on the rf gain control. Even with that kind of receiver (or with a modern direct-conversion job with no agc), one-handed tuning becomes possible when you use audio compression.

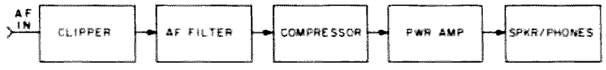


Fig. 1. Audio processor block diagram.

So, I decided my fancy solid-state processor must begin with a peak clipper, followed by a good stage of selectivity, followed by compression, and *then* (finally) by enough power to drive a loudspeaker and phones. It must be connected to the receiver only by a patch cord from the headphone or speaker output to the processor input, so that no modifications need be made to the receiver (see Fig. 1).

Clipping

Clipping and compression are terms which are often misunderstood. Clipping, for our purposes, is the process of whacking off any audio signal which exceeds some preset amplitude. The waveform is grossly distorted and lots of harmonics are generated in the process.

The clipping circuit chosen for this application is the familiar full-wave, series peak clipper (Fig. 2). It works like this:

Audio from the receiver is fed through a capacitor to a pair of small silicon diodes (1N914s or similar) in series, anodes connected together. A positive voltage is applied to the anodes, so that current flows through both diodes to ground through load resistors.

As long as those diodes conduct, they look like pieces of wire to the audio signal coming in from the receiver. But the moment a positive audio peak voltage becomes greater than the forward bias, the diode ceases to conduct, and the signal can't get any bigger in that direction. The negative half cycle, though, goes through because it only forward biases the diode even more.

But the other half cycle then collides with the second diode, with reversed polarity, and the other audio peak is clipped off. A good sine wave applied to the clipper comes out looking much like a square wave. Noise pulses, of course, also are clipped. How deeply the signal is clipped depends on how much bias voltage is applied to the diodes by the 10k pot. The voltage can be made so high that no clipping occurs, or so low that no signal gets through at all. The clipper can also be defeated by closing SW2 which shunts the audio around the diodes completely.

In use, the clipping threshold is set at some intermediate point which the operator finds to be comfortable. The setting will be affected, of course, by the audio gain control on the receiver.

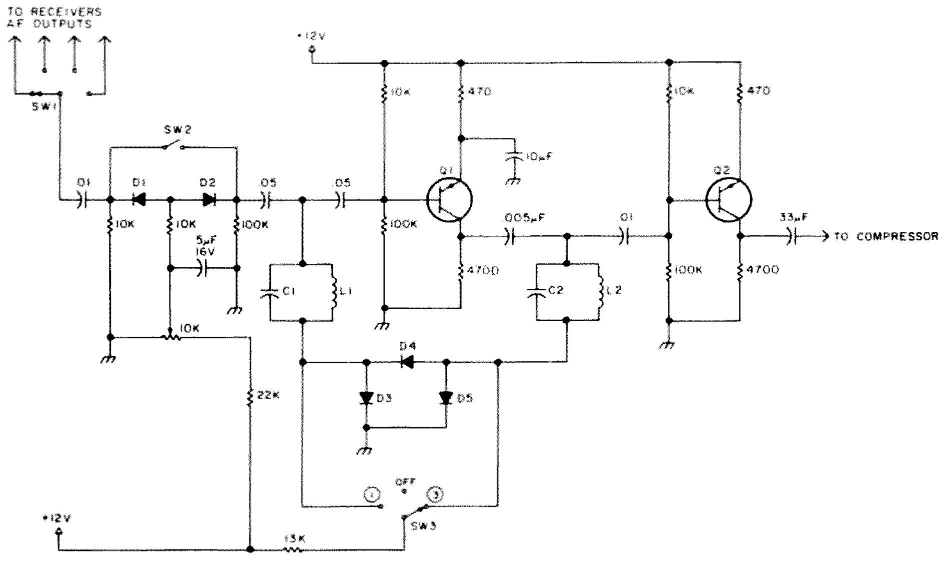


Fig. 2. Clipper-selectivity section of processor. Q1 and Q2 are PNP audio transistors such as the 2N3906. L1 and L2 are 88-mH telephone toroids. See text for C1 and C2.

Selectivity

The output of the clipper is fed to the selective circuit through a capacitor which blocks dc. Any of a variety of selective circuits could be used here, including the popular bridged-T active audio filters using IC op amps. I chose to use parallel-resonant 88-mH telephone toroids because I can change the resonant frequency simply by changing the values of the parallel capacitors. To change a bridged-T involves three capacitors in each pole of the filter. (See Fig. 2.)

The output of the clipper is applied across one 88-mH toroid tuned to 700 Hz with capacitors totaling 0.57 μF. Another blocking capacitor isolates the toroid from the dc on the base of Q1. The transistor amplifier restores the considerable insertion loss caused by the clipper and the toroid filter. Any handy transistor can be

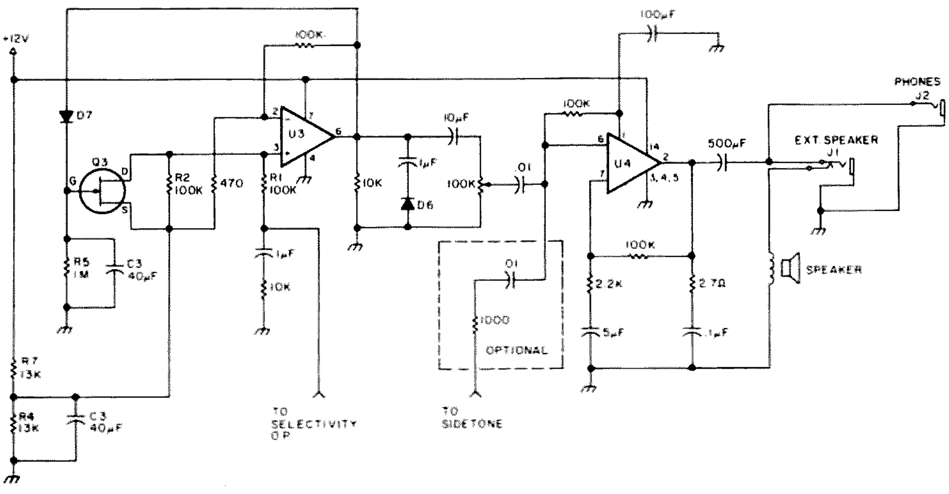


Fig. 3. Audio compression and power. Q3 is a 2N3819 FET or any similar audio FET. U3 is a TL081 FET op amp. U4 is an EC5700, ULN2277, or FE IC27. D1-D7 are 1N914s or similar.

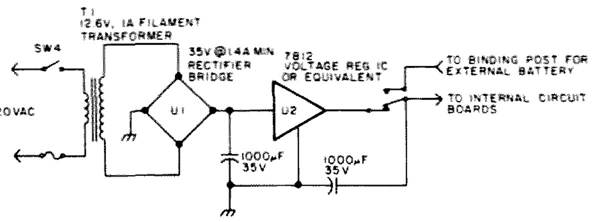


Fig. 4. Power supply suitable for the audio processor.

used, and the ones I used were junk box PNP silicons which were probably refugees from a Radio Shack red-tag sale. If you use NPNs or germaniums, be sure to make the necessary circuit changes, including polarity and bias. Almost any inexpensive audio transistor in a suitable amplifier circuit will do the job.

The output of Q1, taken from the collector, is coupled to the second toroid, tuned to the same frequency as the first, and again the insertion loss is restored by Q2. Actually, it is somewhat more than restored, and the output is ample to drive the next stage.

In operation, you can elect to use both toroids, for maximum selectivity, only one toroid for intermediate sharpness, or neither one, leaving you with only the selectivity of the receiver itself. Switching is done by means of diodes, so that signal leads can be kept on the circuit board, and not run to the front panel. With SW3 in position 2 (Off), neither toroid is in the circuit because its ground return circuit is open.

In position 1, positive voltage is applied to D3, making it conduct and become virtually a short circuit to ground, thus completing the toroid circuit. In position 3, voltage is applied to D5, thus grounding the return for L2. The same voltage turns on D4 which, in turn, turns on D3 so that both toroids are now in the circuit, for maximum selectivity.

Compression

Compression is a somewhat misunderstood term. Here it is used to mean automatic control of the audio gain so that the amplifier output remains virtually constant, despite large changes in the input level. The process does *not* distort the waveform of the signal. (See Fig. 3.)

In the circuit I chose,[2] the compression amplifier (U3) is a TL081 FET op amp, inexpensive and readily available. The output of the filter is fed to the non-inverting input of op amp U3, and its output is fed to the input of an audio power amplifier chip, U4.

The output of U3 is also fed to a voltage doubler formed by D6 and D7. This generates a positive dc voltage which is proportional to the audio output voltage of U3, and this dc voltage is fed to the gate of FET Q3.

The FET acts simply as a variable resistor. Note that audio coming out of the filter stage is fed to the top of a voltage divider composed of R1 and R2. The input of the op amp is taken from the midway point on this divider. The bottom half of the divider, R2, is paralleled by the source-drain circuit of the FET.

The ground return of the voltage divider is the center of another voltage divider, formed by R4 and R7, across the power supply voltage. This tap is also the ground return for the 470-Ohm resistor in the inverting input lead. This makes it possible to use only a single power supply for U3, rather than two.

With no signal applied to the input of U3, no output is generated, hence no voltage from the voltage doubler. The FET is biased to "pinch off" by the voltage across R2, which makes the gate negative with respect to the source.

When an audio voltage appears at the input of U3, a positive dc voltage appears across the voltage divider and this is applied to the gate of the FET via D7, opposing the negative bias and allowing the FET to begin to turn on. The more audio out from U3, the more positive bias, and the more the FET turns on, making its resistance lower and lower. The effect is the same as moving the input to U3 further toward the ground end of a volume control; it applies less audio voltage to the input, thus cutting back on the output. The result is excellent volume compression in which the output remains almost constant despite great changes in input level.

Some of the output audio is picked off by the volume control and fed to the audio amplifier IC, U4.

Audio Amplifier

A considerable variety of audio amplifier ICs is available. I used a ULN2277 for U4, which provides two Watts per channel, and I only used one channel. An LM386 could be used and will provide about half a Watt of audio to drive a small speaker beyond endurable volume. It costs about one dollar at ham supply houses.[3]

Power Supply

A regulated power supply (See Fig. 4) is used because the regulator IC provides excellent ripple filtering, not because anything needs a regulated voltage. The rectifier is a small, cheap bridge or it can be made up from discrete diodes rated at one Amp or more at 35 volts or more. The regulator chip will deliver one Amp, maximum, regulated, and that's probably three times the actual demand of the system. The output amplifier chip probably can be run directly from the unregulated output of the power supply, provided this does not introduce noticeable hum in the output.

Construction

Construction is straightforward and non-critical. I built the power supply into a corner of a small aluminum cabinet box, using a small piece of perfboard to mount the components. The board was mounted to the chassis with the small metal mounting lugs obtained by drilling them off old-style tie-point strips. This type of mounting is extremely convenient because it permits standing the boards on edge and provides for easy removal for service or modification.

The IC circuits were built on universal circuit boards.[4] One board was sawed in half, and the compressor and clipper built on one half, the output amplifier on the other.

The toroids were mounted on a piece of perfboard with dabs of five-minute epoxy, leads anchored to tie-points, and then the perfboard was bolted to the edge of another type of universal circuit board on which each cluster of four holes is connected together by a foil pad. This is useful for mounting the transistors and other components by their leads.

Each board was stood on edge and bolted to the chassis with brackets. But these should *not* be used for circuit grounds. Grounding each board directly to the chassis will probably result in ground loops which produce hum, noise,

oscillation, and all sorts of nasties.

Instead, use a common ground on each circuit board insulated from the mounting feet, and connect the circuit ground with a wire directly to the negative voltage tie-point on the power supply board.

Operation

After the project passes its "smoke test," you're ready to learn to use it. Hook it up to your receiver and hook up the output to a loudspeaker.

Set the volume control about one-fourth open, put the selectivity switch in the Off position, and turn the clipper on. Feed a steady signal into the amplifier. The tone from a 100-kHz calibrator will work fine. Adjust the clipping threshold, noticing that at the clockwise extreme of the pot, you get no signal output at all. At the counterclockwise position you get no clipping and at points in between clipping is apparent because of the change of audio quality of the clipped signal.

Flip in one filter section and notice that the clipped signal suddenly sounds clean again. The harmonics have been filtered out. The second toroid section won't seem to have much effect in this test—but it will in actual operation.

Now find a place on the receiver dial which is fairly clear of signals, turn off clipping and selectivity, and set the receiver volume control until you can just hear the crackle of background noise in the speaker, or to where you can hear a weak CW signal. Leave the volume control set, and tune across the band slowly, stopping to listen to each signal you come to.

Loud signals are no louder than weak ones, but you will notice that the background noise disappears while a strong signal is present. This is because the compression has reduced the overall gain.

Now tune away from the strong signal to a no-signal spot and listen. Notice that after a few seconds, background noise slowly becomes audible, as the compressor increases gain again. It has a fast-attack, slow-decay time constant.

Decay time is set by R5 and C3 in the gate circuit of the FET. Resistor and capacitor values are chosen to give a delay of several seconds so that the amplifier won't "pump" on a strong CW signal. Instead, it reduces gain in proportion to the average strength of the signal and keeps the gain reduced during the brief key-up periods between letters and words and even during brief pauses.

If recovery time were very short, band noise, weak QRM signals slightly off frequency, and other disturbances would appear in the background instantly whenever the desired station released his key—very tiring and disturbing to the receiving operator. Try it if you like, by temporarily replacing C3 with, say, a 0.47-µF capacitor.

Changes to Play With

The overall design of this unit is quite flexible and, since it is built in modules, with each section on its own circuit board, it is quite easy to experiment.

Various degrees of selectivity can be achieved, for example, by shunting the toroids with resistors, to broaden them, or by adding a third toroid for extreme selectivity. Various kinds of active audio filters can be substituted for the toroids. Skirt selectivity of the toroid filters can be improved by insertion of two 1N914s reverse-connected in parallel between the first toroid and the coupling capacitor to the base of Q1 (see Fig. 1). These are silicon diodes which will not conduct at all until forward voltage across the junction exceeds about 0.7 volts. Therefore, the base of Q1 won't "see" any output from the toroid until the voltage rises above 0.7 volts, thus effectively rejecting low-level QRM on the skirts of the filter.

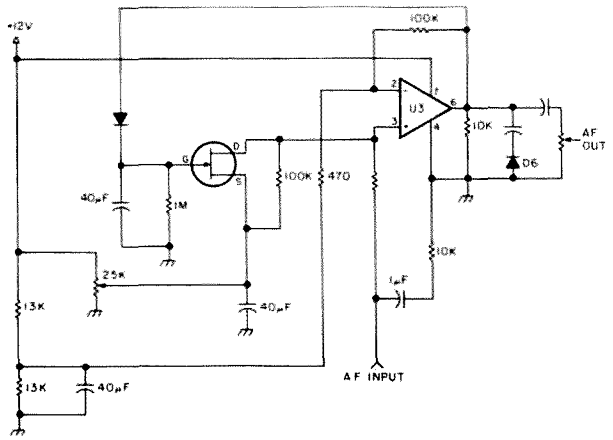


Fig. 5. Compression control modifications.

The compression threshold can be manipulated over a wide range, if desired, since compression does not begin on weak signals until they reach a certain minimum voltage. That's because the FET is pinched off and some of the bias must be overcome before the FET drain begins to conduct at all.

However, if the drain is removed from the R3-C4 tap (leaving the other components attached), and connected to the wiper of a pot, this delay of the attack can be changed at will (see Fig. 5). One end of the pot is connected to +12 V dc and the other end is grounded. When the wiper is grounded, the FET turns fully on, reducing the op-amp output sharply.

When the wiper is moved toward the top of the pot, the source becomes more and more positive. Hence, the gate becomes more and more negative with respect to the source, and more and more compression bias is required from the op amp to turn on the FET. It is possible to set the pot to provide compression on *any* signal, no matter how weak, or to prevent compression of any but the very stongest signals.

An S-meter can be built which will show the relative strength of received signals by measuring the compression bias (see Fig. 6). A simple FET voltmeter reads the bias generated by the op-amp output.

The unit can be muted for full break-in (QSK) CW operation if desired by us-

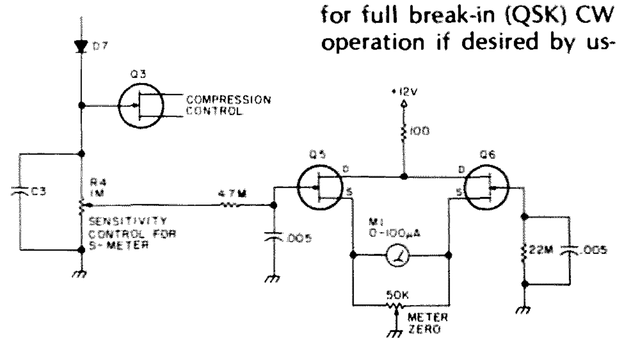
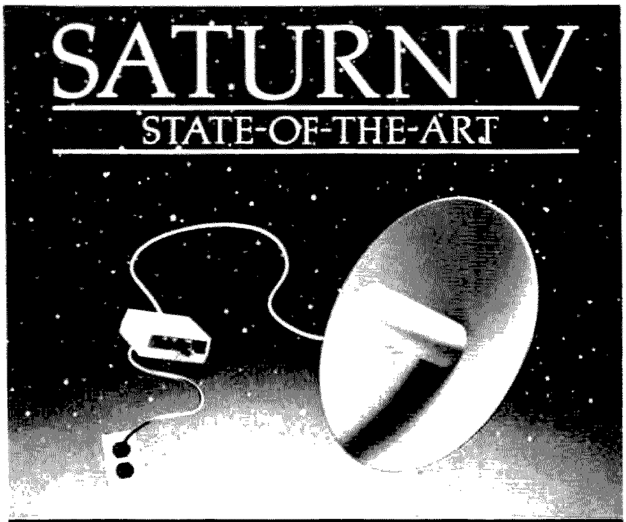


Fig. 6. Optional S-meter circuit.



The Saturn V is a deep fringe microwave receiver for homeowners that are outside of the service area of local pay TV stations (i.e., HBO, Showtime). It is normally used within line of sight of a transmitting tower in a 50 mile range and is simply attached to your TV antenna mast. This unit is completely ready to install including all cable and mounting hardware. It is designed to be installed by the homeowner.

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ing a transistor switch to clamp the clipper diodes when the key is down. The keying signal for the transistor can be a logic low or high picked off from a solid-state electronic keyer, such as the Accu Keyer, or by the relays of other keyers. See Fig. 7.

When the muting transistor is off, which it always is when the key is up, it has no effect on the operation of the diode clipper, but SW2 must be open for muting to function properly.

When the key is down, the transistor turns on to saturation. This offers a low-resistance path to ground for the dc bias on the diodes, effectively grounding both the diodes and the audio signals passing through them. Because of its lower junction voltage drop, a germanium transistor will work better here than silicon. Even so, muting is not absolute and some signal from the receiver gets through at low level. The circuit does not affect operation of the rest of the audio processor.

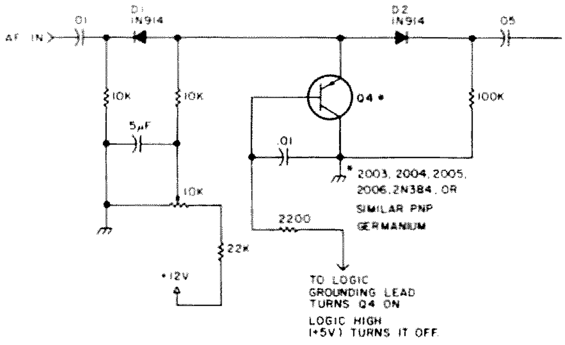

Fig. 7. Muting circuit added to peak clipper.

Sidetone can be injected into the amplifier when the key is down, making it appear in the same speaker which carries the incoming signals (see Fig. 3). Since the sidetone is injected after the clipping, compression, and selectivity, it is not affected by processor operation and can be set for any convenient pitch or volume.

Several inputs can be provided for the processor, selecting them by switch from the front panel. This makes it possible to use the processor on just about any receiver in the shack.

Auxiliary outputs often come in handy, too, for driving phone patches and similar uses. I provided mine with three front-panel headphone jacks—one of each of the popular sizes of plugs—so that any handy headphones can be plugged in without a hassle.

I built in a little two-inch speaker for convenience in testing and portable operation, but a phone jack is provided for an external speaker. Plugging in the external speaker mutes the internal one. Both speakers can be muted by a front-panel switch, if desired.

A back-panel switch can be added to allow operating the unit from an automobile battery for Field Day or emergency situations. The SPDT switch is connected with the pole to the internal +12-volt lines of the circuit boards. One contact is connected to the output of the 12-volt regulator chip. The other contact is hooked to a back-panel binding post which goes to the external battery. A second binding post should be provided to permit connection to the battery negative.

A 1000-μF 35-volt capacitor is connected from the pole of the switch to ground. It helps with the filtering of the regulator output and, when used on a car battery, it helps to subdue ignition and voltage regulator noises and alternator whine.

Troubleshooting

Troubleshooting the processor is as simple as troubleshooting can be. Nothing is critical as to value or adjustment, except that the tuned filter circuits must be on exactly the same frequency. Failure to operate properly will almost always prove to be traceable to a wiring error or a faulty diode, transistor, or IC chip, a solder bridge on a circuit board, or failure to solder a connection. ■

References

1. George Thurston W4MLE, "A Versatile Receiver Audio System," *QST*, May, 1962.
2. C. W. Andreasen N6WA, "The Amazing Audio Elixir," *73*, September, 1979. Note that the diagram in this article has an error. The lead from CR2 to the gate of the FET is *not* connected to the voltage divider or to the source of the FET. What is shown as a connection dot should be a non-connecting cross-over.
3. Suitable audio amplifier chips available from Radio Shack and other suppliers include: LM1877N-9, dual-channel, two Watts per channel, (catalog number 276-702); LM386, one-channel, 400-mW output (276-1731); LM383/TDA2002, one-channel 8-Watts (276-703); BA521, one-channel 5.8 Watts (276-704).
4. The IC board is available from several suppliers, such as Global Specialties Co., 70 Fulton Terrace, Box 1942, New Haven CT 06509, or 351 California St., San Francisco CA 94104, or from Radio Shack, catalog number 576-170, for about $3.00 each. This board is perforated for IC chips and has lands which permit connecting up to four components to each IC pin.

The second type of universal board has a quad land pattern, that is, each cluster of four holes in a square is connected by foil. It is excellent for mounting transistors and other components by their leads. Sold by Calectro (G.C. Electronics), catalog number J4-609, for less than $2.00 each.

73 Magazine Staff

A Tuner for Antenna Fanatics

Anyone experimenting with antennas needs a darned good tuner. Construct this one and save your finals.

Various antenna tuner networks for the HF bands have come and gone over the years, but two forms have evolved as time-proven favorites—the Pi and T networks. The basis for the durability of these networks is a combination of electrical as well as constructional reasons.

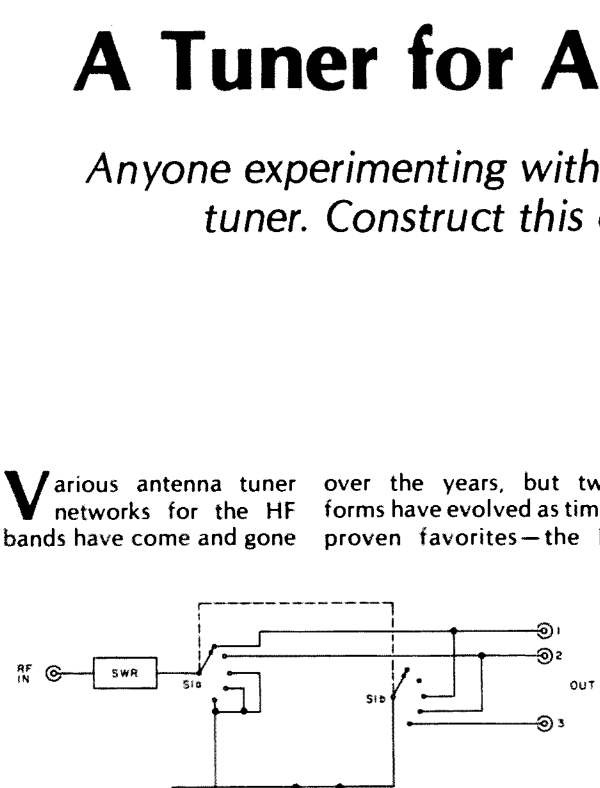

Fig. 1. Tuner circuitry. The S2 switch arrangement may appear complex, but wiring is not complicated nor are long lead lengths introduced, since most of the wiring is between switch lugs. Normally, a two-wafer switch would have to be used, although single-wafer surplus switches having a 5P3T action can be found. C1 and 2—at least 250 pF each, rated at 1.5 kV for 300 Watts, 2 kV for 500 Watts, and 4 kV for 1 kW; L—18 to 28μH, #10 or 12 wire; S1 and 2—Centralab PA-2000 series or similar.

The Pi network will not match an extreme range of impedances, but it is relatively easy to construct and adjust in operation. Its main disadvantage is that it requires considerable amounts of capacitance on the lower frequency bands when working into low-impedance loads. Usually, padding capacitors are required across the variable capacitors on the lower frequency bands when a high-power tuner is being constructed since 1,000- or 2,000-pF variable capacitors rated at 2 to 3 kilovolts are not exactly common items.

On the other hand, the T network does not require extreme amounts of capacitance even on the low-frequency bands when matching into the same or even greater range of load impedances than a Pi network will accommodate. The T network is, however, slightly more tedious to adjust and also to construct since the variable capacitors used must have both their stator and rotor sections above ground. The popular "Transmatch," by the way, is a basic variation of the T network.

But, why not have the best of both networks in a single multiband tuner? This article describes a switchable, multi-network tuner which is designed to optimize the matching possibilities available using commonly-available L/C components of moderate electrical and physical dimensions and, of course, of moderate cost. The tuner can be tailored to handle PEP output powers from 500 to 1000 Watts. The physical dimensions are quite moderate for the power-handling capabilities involved and one easily can add such features as selectable antenna switching and swr monitoring.

The schematic of the tuner is shown in Fig. 1. As shown, it incorporates selectable LC-, CL-, or T-network tuning, input switching direct to any of three loads (one of which can be a dummy load), switching using the tuner network to any one of two selectable antenna loads, and complete, internal swr measurement circuitry. Of course, one can scale up or down the possibilities shown in the schematic in any way desired in order to construct just the basic tuner, expand the antenna switching possibilities, etc.

The reason for having selectable LC- or CL-network tuning (a reversible L network) instead of a simple Pi-network option is to further increase the mileage obtainable out of the components used. Since two variable capacitors have to be used in the design of the tuner, the option is available to use them in a conventional Pi-network manner as tunable input/output capacitors or to parallel them and use them as combined output or input capacitors in a reversible L network. The latter will provide a greater range of impedance-matching possibilities at the expense of only a bit more component switching complexity, and so it was used.

If one uses a conventional input/output tuned Pi network with extremely wide-range variable capacitors, it usually will be found that any load that can be matched using both variable input/output capacitors can also be matched using only *either* a variable input *or* output capacitors and a suitable value of inductance. However, the capacitance range of a single variable capacitor required will usually be less than the combined capacitance of separate input/output variable capacitors in a Pi network.

The practical construction details of the tuner are not difficult to follow or perform if you approach them on a step-by-step basis. The 500-Watt output-rated version of the tuner is housed in an attractive two-tone blue/gray Radio Shack enclosure (#270-269) measuring 7-7/8" × 3-1/2" × 5-7/8". This aluminum housing is easy to work and you can construct the tuner using basic hand tools.

After you have initially sized-up the placement of components within the enclosure, drill or punch out the necessary mounting holes on the rear panel for the coax connectors, on the bottom of the enclosure for inductor and capacitor mounting, and on the front panel for control shafts, switches, meter, etc. Generally, the following sequence of mounting and wiring and components will make the tuner go together easily:

1) Mount the front-panel network changeover switch and the rear-panel coax connectors.

2) Mount the two variable capacitors. These capacitors have to be "above" ground. There are numerous ways to achieve a suitable mounting. The simplest is probably through the use of plastic #6 mounting screws/nuts with 1/4" spacers to keep the capacitor rotors above ground. If such material is not readily available, a 1/4"-thick piece of Plexiglas™ or bakelite can be used to raise the capacitors above the enclosure bottom using metal hardware.

3) Wire up the network changeover switch to the capacitors with leads extended to where the inductor and antenna selector switch will be mounted.

4) Mount the variable inductor and the swr measurement circuitry (if used).

5) Mount the antenna selector switch to the back panel (using 1/2" to 3/4" standoff hardware) and wire it up.

6) Mount the insulated shaft couplings on the variable capacitors, extension shaft to the antenna selector switch, etc.

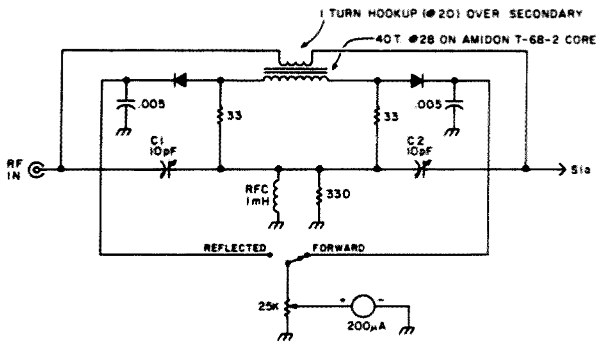

Fig. 2. The swr circuitry is simple but sensitive and needs no shielding inside the tuner enclosure. With a 50-Ohm carbon resistor on the S1 side and the meter switch to reflected, adjust C1 for minimum meter reading. Do the same with C2 when the resistor is connected to the rf in side and rf is fed into the S1a side of the circuit.

Of course, you can vary the location of the components in a variety of ways, but you should more or less plan out the construction of the tuner in the manner illustrated above. It really takes less time to complete than is involved in even assembling a commercial kit which often has rather laborious point-to-point wiring instructions.

Another swr bridge circuit was constructed using a toroid-core transformer and it worked very well. The circuitry of the bridge is shown in Fig. 2. The components are mounted on a small piece of perforated board stock; there is no need to etch a board for the few components involved and they can be wired together directly.

The board is mounted inside the rear panel of the tuner directly by the input coaxial connector. No shielding is required since the toroid is largely self-shielding. The sensitivity allows for measurements with 10 to 20 Watts of transmitter output power even on the low-frequency bands. The only thing that you must do, however, is to balance out the stray capacitances in the circuitry as noted in the caption for Fig. 2. The procedure is simple but it cannot be neglected if proper readings are to be obtained on 10 and 15 meters.

The meter used happened to be a surplus CB one that had an swr scale, but any inexpensive meter with a 200-mA or more sensitive movement will suffice. There is no real need to calibrate the meter since it normally is used only to adjust the tuner for a minimum reading in the reflected switch position once the meter has been adjusted for a full-scale reading in the forward switch position.

A minor point, by the way, about the meter switch used: It is spring-loaded, so it must be pushed down to read forward and will snap back to its reflected position (labeled SWR). This small refinement makes it rather easy to adjust the tuner since the way the switch and meter adjustment control are placed on the front panel the index finger on one hand can be used to depress the switch while the thumb and middle finger are used to adjust the control. The other hand is free

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to adjust the tuning controls.

Speaking of controls, there is no turns indicator on the rotary inductor. Regular turns counters take up a lot of enclosure space and are not all that necessary unless you insist on extremely fast control presetting. In reality, if you note the setting of all the other controls for the band/antenna being used, it is a simple matter to rotate the inductor for approximate minimum swr and then finish up the tuning by going back and forth between the inductor and capacitor tuning controls.

It's no secret that it generally only makes sense to home-brew a tuner if one can find the components necessary at reasonable prices. If you built a 500-Watt version of this tuner using all new, off-the-shelf parts, the parts cost could easily run around $120. On the other hand, using surplus or new surplus parts, the cost could be as low as $25. Simply hunt around for the parts needed at the right prices. Fair Radio Sales (1016 E. Eureka, Box 1105, Lima OH 45802), for instance, which frequently advertises in *73*, often has very good buys on transmitting-type variable capacitors and inductors.

The tuner has been labeled as a "Universal Coupling Unit." That euphuistic name was only the result of having a limited selection of words available in a rub-on lettering set. No tuner will, of course, couple to absolutely all loads. The tuner described will couple a 50-Ohm output transmitter to just about any reasonable antenna load; the same as can be done by commercially available tuners which use the same type of circuitry and component dimensions. ■

Digital Basics

This is no time to be a digital illiterate. Part III reveals the secrets of multivibrators, shift registers, and other notorious devices.

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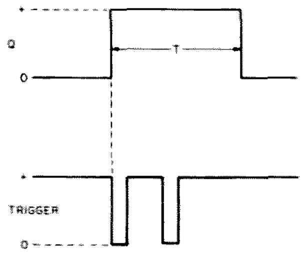


Fig. 1(a). One-shot multivibrator. Trigger pulse causes output to go HIGH for period T. The second pulse has no effect.

The first two parts of this three-part series led you step by step into the digital electronics swimming pool. We now can wade in past the ankle-deep water of the kiddies' pool and venture into knee-deep water. Thus far, we have discussed the various digital IC logic families, assorted types of gates, and a variety of flip-flops. We now will turn to the subjects of multivibrators and counters.

Multivibrators

A multivibrator is basically a pulse-producing circuit. There are three basic forms of multivibrator: *monostable, bistable,* and *astable*. It takes little imagination to detect that these designations refer to the *stable output states* that are possible for each type of circuit.

The monostable multivibrator has but *one stable state* (usually the state in which Q = LOW . . . but not always). Triggering the monostable multivibrator causes the Q to go HIGH for a time, but since this is not a stable state, Q will drop LOW again when a pre-determined time period has elapsed. Monostable multivibrators are also called *one-shot* circuits and also (erroneously, albeit graphically) *pulse-stretcher* circuits. The latter label is a misnomer because the circuit does not actually stretch a pulse but generates a *new* pulse that has a longer period.

The bistable multivibrator has two stable states. It can remain in either state (i.e., Q = LOW or Q = HIGH) indefinitely. The RS flip-flop is an example of a bistable multivibrator.

The astable multivibrator has *no* stable states. It is in-

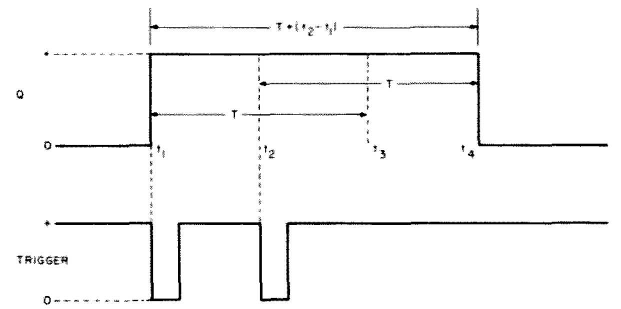


Fig. 1(b). A retriggerable monostable multivibrator can be retriggered while the output is still HIGH. Note that the total duration of the HIGH state is not 2T.

capable of remaining in either Q LOW or Q HIGH states. The Q output of the astable multivibrator will flip back and forth between the HIGH and LOW states, producing a square-wave pulse-train output signal. For this reason, the astable circuit is usually used to produce the clock pulses found in digital circuits.

There are several ways to produce each of these types of multivibrator. Space prevents us from considering all of them. We will examine a few circuits built from discrete gates and the integrated circuits. Some IC devices, like the 555 timer, will operate in either the monostable or astable mode.

When we speak of bistable multivibrators, we actually are talking about the RS flip-flop. Recall from the earlier sections of this article that the RS FF can remain happily in either the Q=LOW or the Q=HIGH states indefinitely.

Most monostable multivibrators will not respond to further input trigger pulses until the period of the output pulse has "timed out," i.e., the output has returned to its stable state. Monostables that will not respond to further trigger commands until the output duration has expired are *nonretriggerable* monostables.

Some one-shot circuits, however, are *retriggerable*, meaning that they will respond to further input trigger commands while the one-shot is in the unstable state (i.e., before it has timed out). Consider Fig. 1 to see how this works. Fig. 1(a) shows the operation of the regular nonretriggerable one-shot multivibrator. The first trigger pulse causes the output to go HIGH and it remains HIGH for period T. A second trigger pulse has no effect on the one-shot because it occurs before T expires.

Now consider Fig. 1(b). This is a timing diagram for the retriggerable monostable multivibrator. The output goes HIGH when the first pulse arrives. But before T expires, a second trigger pulse is received. This second pulse causes the one-shot to retrigger, so the output will remain HIGH for an additional period T. Note that the total duration of the HIGH state is not 2T, but T plus the portion of the first period that expired prior to the second trigger, or $T+(T_2-T_1)$.

An example of a monostable multivibrator built from a CMOS type-D flip-flop is shown in Fig. 2. Recall the rules for the type-D FF: (1) Since D is HIGH, a HIGH will be transferred to the Q output when the *CLK* line goes HIGH, and (2) when the *clear* line goes HIGH, the Q output is forced LOW. The operation of the one-shot circuit in Fig. 2, then, is as follows:

a) When the circuit is at rest, Q is LOW and any charge on capacitor C1 is drained off through diode D1.

b) When a trigger pulse is received by the *CLK* input, Q goes HIGH. When Q is HIGH, capacitor C1 will charge through resistor R1.

c) When C1 has charged to a potential of approximately 2 volts, the *clear* input thinks it is HIGH, so the FF will force Q LOW.

d) The period that Q was HIGH, i.e., the period of the one-shot, is determined by the time constant of R1C1 and the potentials of the Q output and the point at which the *clear* input thinks that it is HIGH instead of LOW.

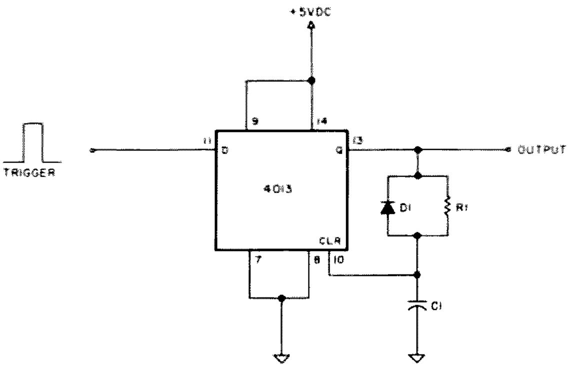


Fig. 2(a). A CMOS flip-flop is the basis for this monostable multivibrator. R1 and C1 determine the length of the pulse. D1 allows the flip-flop to be retriggered immediately after clearing.

The circuit in Fig. 2(a) uses a diode (D1) across the timing resistor (R1) to discharge C1 during the period when Q is LOW. This diode is not strictly necessary but serves to speed up the circuit considerably. Without D1, the charge on capacitor C1 would bleed off through R1. But this would require another R1C1 time constant (or so) before the voltage across C1 would discharge enough to permit retriggering of the one-shot. The purpose of D1 is to discharge C1 rapidly so that retriggering can occur almost immediately after Q drops LOW—see the waveform in Fig. 2(b).

The use of D1 creates a little problem, however.

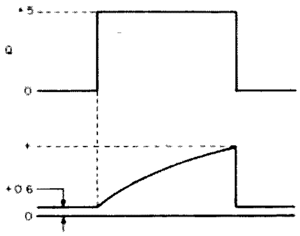


Fig. 2(b). The potential across C1 never drops below 0.6 volts because of the presence of D1.

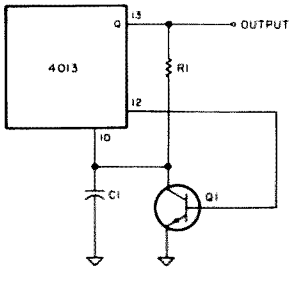


Fig. 3. Monostable multivibrator. The diode in Fig. 2(a) is eliminated by using Q1 to discharge C1.

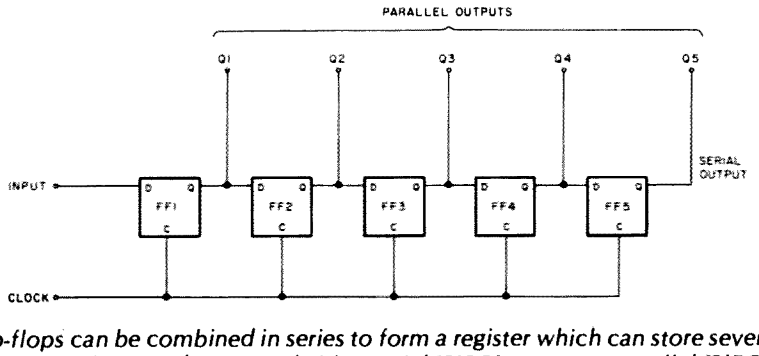


Fig. 4. Flip-flops can be combined in series to form a register which can store several bits of data. This version has serial input and either serial (SISO) output or parallel (SIPO) output.

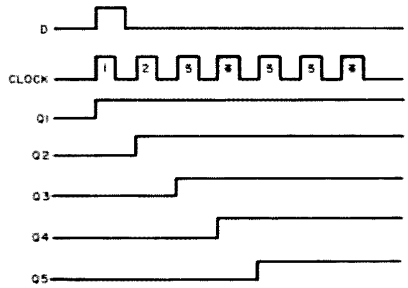


Fig. 5. The data bit (0) is transmitted through a five-stage SISO shift register by clocking the register five times.

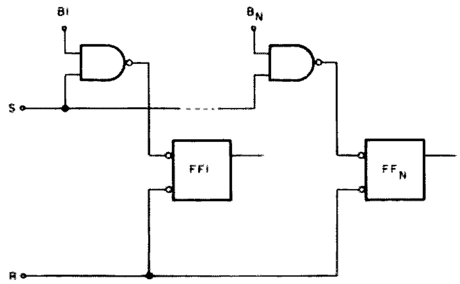


Fig. 6. Data is entered into this parallel-entry shift register via B1-B_n. Before entry, the register is reset via R. The data is then loaded by bringing the set line (S) HIGH.

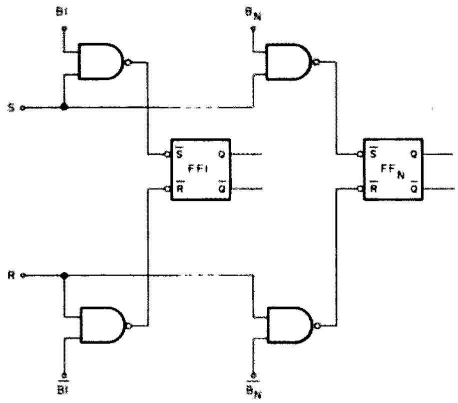


Fig. 7. The jam parallel-input shift register eliminates the need to clear the registers.

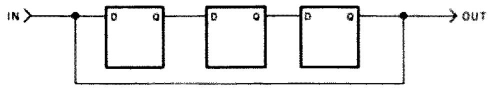


Fig. 8. A recirculating shift register automatically couples the output data back to the input. This is something like a dog chasing its tail.

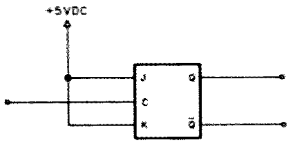


Fig. 9(a). The core of most frequency counters is the J-K flip-flop configuration. In this case, the J and K inputs are both tied HIGH.

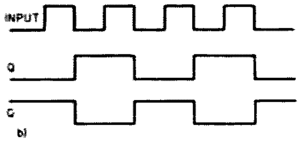


Fig. 9(b). A single J-K flip-flop is a divide-by-two counter.

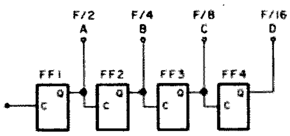


Fig. 10(a). By cascading several J-K flip-flops, the division ratio increases by powers of two.

The charge potential across C1 cannot drop lower than the function potential of the diode (200 to 300 millivolts in germanium types and 600 to 700 millivolts for silicon types). Fig. 3 shows the circuit for a modified version that uses switching transistor Q1 to discharge C1. The base of transistor Q1 is driven by the NOT-Q output of the 4013 flip-flop.

Shift Registers

A flip-flop is able to store a single bit of digital data. When two or more flip-flops are organized to store multiple bits of data, then they constitute a *register*. Most registers are merely specially-connected arrays of flip-flops.

There are several different circuit configurations that one would call a register, and we classify them according to the manner in which data is input and output to and from them. We have, for example, *serial-in-serial-out* (SISO), *serial-in-parallel-out* (SIPO), *parallel-in-parallel-out* (PIPO), and *parallel-in-serial-out* (PISO).

Fig. 4 represents both SISO and SIPO shift registers. The only significant difference is that the parallel output lines, used on the SIPO register, would be absent on the SISO register.

The SIPO shift register consists of a cascade chain of type-D flip-flops that have their clock lines connected together. Recall the rules for type-D flip-flops: Data can be transferred from the D input to the Q output only when the clock input is HIGH. The input can change at will and the output will remain the same as long as the clock line is LOW. But if the clock line goes HIGH, the Q output will follow the D input. The Q output will retain the last valid data present before the clock dropped LOW again.

This rule can be applied to the situation shown in Fig. 5, where we show the transmission of a single bit of data from left to right through a SISO shift register. At the occurrence of the first clock pulse, the input line is HIGH. This point is the D input of FF1, so a HIGH, which is applied to the D input of the second flip-flop (FF2), remains after the clock pulse disappears.

When the second clock pulse arrives, FF2 sees a HIGH on its D input and FF1 sees a LOW on its D input. This situation causes a LOW at Q1 and a HIGH at Q2.

The third clock pulse sees a LOW condition on the D inputs of FF1 and FF2 and a HIGH at the input of FF3. The third clock pulse, then, causes Q1 and Q2 to be LOW and Q3 to be HIGH.

Note that the SISO input remains LOW after the initial HIGH during clock pulse number 1. This means that the single HIGH condition will be propagated through the entire SISO shift register, one stage at a time. The HIGH bit will shift one flip-flop to the right each time a clock pulse arrives.

If the data at the input had changed, then the bit pattern at that input would be propagated through the shift register.

The shift register in Fig. 4 is a five-bit, or five-stage, register (any bit length could be selected). On the sixth clock pulse, therefore, the HIGH is propagated out of the register, so all flip-flops are now LOW.

The SISO shift register can be made into a SIPO device by adding parallel output lines at Q1, Q2, Q3, Q4, and Q5.

One use for the SIPO register is serial-to-parallel binary-code conversion. For economic reasons, digital data usually is transmitted as a serial stream of bits, i.e., the bits of the digital word are sent over a communications link. But most computers and other digital instruments use a parallel form of data entry. Parallel data transfer is more expensive but is considerably faster than serial transmission. If, for example, we have an eight-bit system, we would need an eight-stage SIPO shift register to convert the serial code to parallel form. The code is entered into the SIPO register one bit at a time so that after eight clock pulses the first bit will appear at Q8 and the last bit at Q1.

Parallel-entry shift registers are faster to load than serial-input shift registers. This is because a single bit can be changed, if needed. In the serial type, to change a single bit of data requires us to ripple through the entire contents.

There are two basic forms of parallel data entry: *parallel* and *jam*. In parallel entry, shown in the partial schematic of Fig. 6, the register must first be cleared (i.e., all bits set to zero) by bringing the *reset* line momentarily LOW. The data that is applied to inputs B1 through B_n can be loaded into the register by momentarily bringing the *set* line HIGH.

The jam entry circuit shown in the partial schematic of Fig. 7, is also able to load data from bits B1 through B_n. While jam entry may not look superior at first glance, it is, because IC shift registers using this technique have internal inverter stages at the complement inputs. These have their inputs connected to

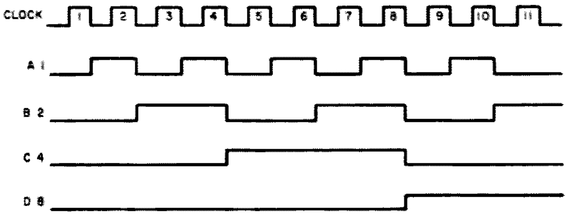


Fig. 10(b). A modulo-16 ripple counter has four outputs.

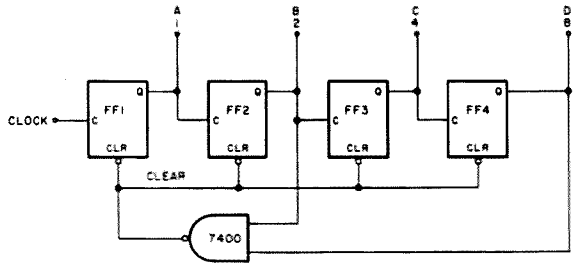


Fig. 11(a). A counter can have something other than a divide-by-two ratio when the flip-flops are forced to reset. The 7400 turns a divide-by-sixteen counter into a divide-by-ten circuit.

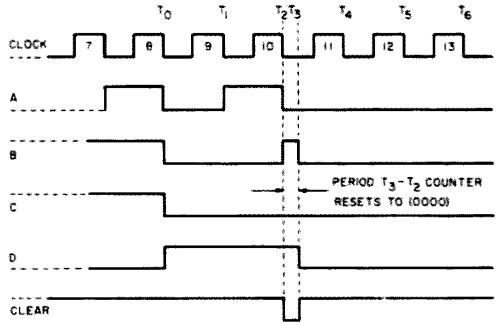


Fig. 11(b). After ten pulses, the counter resets. The result is a decimal-based counter.

the non-complemented inputs, eliminating the need to clear the register before loading.

A recirculating shift register is shown in Fig. 8. Since the output of a serial shift register allows the outside world to see only one bit at a time, we must empty the entire contents of the shift register in order to read these contents. But that would ordinarily destroy the data, because the input would be HIGH or LOW during the entire operation. A single-read operation, then, would fill up the register with all ones or zeros. The recirculating shift register connects the output (serial output) back to the input, so that a read operation would automatically rewrite the data back into the shift register.

Digital Counters

A *digital counter* is a device or circuit that operates as a *frequency divider*. The most basic digital counter is the J-K flip-flop connected with the *J* and *K* inputs tied HIGH (i.e., placed in the clocked mode). This makes the output produce one output pulse for every two input pulses. It is, then, a binary or divide-by-two counter.

Those fancy digital frequency/period counters are nothing more than digital divide-by-10 counters connected so that the binary-coded output is converted to a decimal display.

There are two basic classes of digital counter circuits, serial and parallel. The serial counters are called ripple counters because a change in the input must ripple through all stages of the counter to its proper point. Parallel counters also are called synchronous counters.

In a ripple counter, the data is transferred serially, which means that the output of one stage becomes the input of the next stage.

The basic element in most counters is the J-K flip-flop. See Fig. 9(a). Note in the figure that the *J* and *K* inputs are permanently tied HIGH, so they will remain active.

A timing diagram for this divide-by-two circuit is shown in Fig. 9(b), and it shows the action of the circuit. J-K FF outputs change state on negative-going transitions of the clock pulse. In Fig. 9(b), the first negative-going transition causes the Q output to go HIGH. Q will remain HIGH until the input sees another negative-going clock pulse. At that time, the output will drop LOW. The action required to make a complete output requires two clock pulses, so this J-K flip-flop is dividing the input frequency by two.

We can make a binary ripple counter by cascading two or more stages, as shown in Fig. 10(a). This particular circuit uses four J-K FFs in cascade. Any number, however, could be used.

The major problem with this type of counter is that only those division ratios that are powers of two can be accommodated. In the four-stage circuit shown, the possible division ratios are 2, 4, 8, and 16.

Frequency division is one major use for a counter circuit. In some electronic instruments, for example, we may want to prescale a fre-

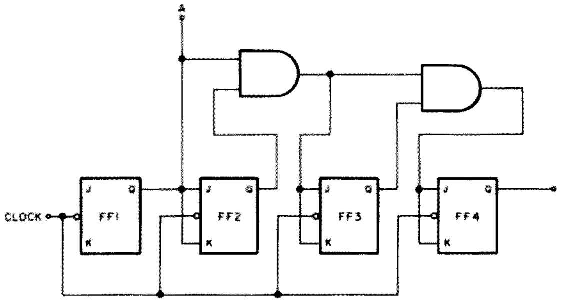


Fig. 12. By feeding the clock inputs in parallel, a synchronous counter becomes much faster than the ripple version.

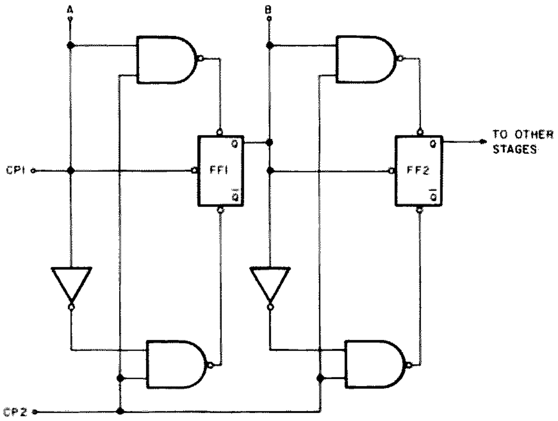


Fig. 13. A preset counter can be made by using a jam input. When CP2 is raised HIGH, a preset bit pattern is entered.

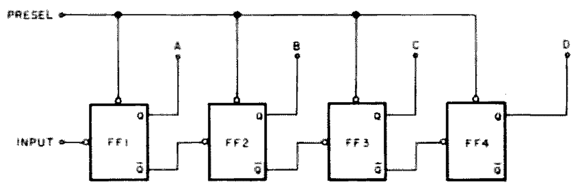


Fig. 14(a). A counter can count down by toggling each flip-flop with the preceding stage's $\overline{Q}$ output.

quency, i.e., divide it from some other frequency to a lower frequency that can be handled by a digital counter or other digital instrument.

But this is only one application for the counter circuit. One of the most common applications, alluded to in the last paragraph, is to *count*, i.e., tell us the total number of pulses that passed. Consider again the circuit of Fig. 10(a) and the timing diagram of Fig. 10(b). Outputs A, B, C, and D are coded in binary, with A being the least significant bit and D the most significant. These are weighted in a 1-2-4-8 code system to represent decimal digits 0 to 9 or hexadecimal digits 0 to 15. These are the normal weights of the binary number system.

Consider the timing diagram of Fig. 10(b). Note that all B output changes occur following the arrival of a pulse. After pulse number one has passed, the Q_A line is HIGH and all others are LOW. This means that the binary word on the output lines is 0001_2 (i.e., 1_{10}); one pulse has passed.

Following pulse number 2 we would expect 0010_2 (i.e., 2_{10}) because two pulses have passed. Note that Q_B is HIGH and all others are LOW. The digital word is, indeed, 0010_2.

The counter in Fig. 10(a) is called a *modulo-16*, or *base-16*, counter, or a hexadecimal counter (all meaning the same thing). The output of a *hexadecimal* counter can be decoded to drive a display device that indicates 0 through 9 (i.e., decimal) or 0 through F (hexadecimal). In most applications where a real, live, human is to read the display, a *decimal* readout is provided.

Decimal Counters. A decimal counter operates in the *base-10*, or *decimal*, number system. The most significant bit of a decimal counter produces one output pulse for every ten input pulses. Decimal counters are also sometimes called *decade counters*. The decimal counter forms the basis for digital *event*, *period*, and *frequency* counters. Thus, the hexadecimal counter in Fig. 10 is not suitable for decimal counting unless it is modified for base-10 operation.

Fig. 11 shows a TTL hex counter modified by adding a single TTL NAND gate. Recall that a TTL J-K FF uses inverted inputs for the clear and set functions. As long as the clear input remains HIGH, the flip-flop will function normally, but when the clear input is momentarily brought LOW, then the Q output of the FF goes LOW.

The decade counter in Fig. 11(a) is connected so that all four clear inputs are tied together to form a common clear line. This line is connected to the output of a TTL NAND gate (i.e., one section of a 7400 device). Recall the rules of operation for the TTL NAND gate: If either input goes LOW, then the output goes HIGH, but if both inputs are HIGH, then the output goes LOW.

The idea behind the circuit of Fig. 11 is to clear the counter to 0000 following the tenth input pulse. Let's examine the timing diagram in Fig. 11(b) to see if the circuit does the correct thing. Up until the 10th pulse, this diagram is the same as for the base-16 counter discussed previously.

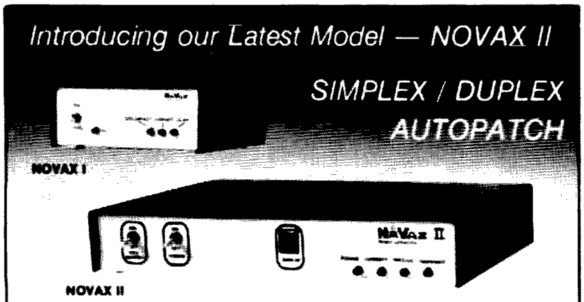
The output of the NAND gate will keep the clear line HIGH for all counts through 10. The inputs of this gate are connected to the B and D lines. The D line stays LOW, forcing clear HIGH up until the 8th input pulse has passed. At that time—T_0 in Fig. 11(b)—D will go HIGH and bit B drops LOW, so the clear line remains HIGH for the 9th pulse.

The clear line will remain HIGH until the end of the 10th pulse. At that point (T_2) both B and D are HIGH, so the NAND gate output drops LOW, clearing all four flip-flops (i.e., forcing them to the state where all four Q outputs are LOW). The counter is therefore reset to 0000.

The reset counter produces a 0000 code, so the B and D outputs are now LOW, forcing the clear line HIGH again. The entire reset cycle occurs during period $T_1 - T_2$). This period has been expanded greatly for graphic illustration purposes in the figure, but actually takes only nanoseconds or microseconds.

The 11th pulse will increment the counter one time, so the output will be 0001_2. The count sequence, in decimal, then, is 0-1-2-3-4-5-6-7-8-9-0-1 . . . etc. The output code is a ten-digit version of four-bit binary (hexadecimal) and is called *binary-coded decimal*, or BCD.

Synchronous Counters. Ripple counters suffer from one major problem: *slow speed*. The counter elements are wired in cascade, so an input pulse must ripple through the entire chain before it affects the output.



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• Toll Restrict	NO	YES
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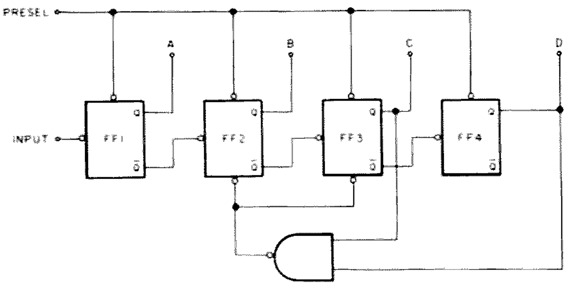


Fig. 14(b). This decade counter counts down, starting at the binary state 1001.

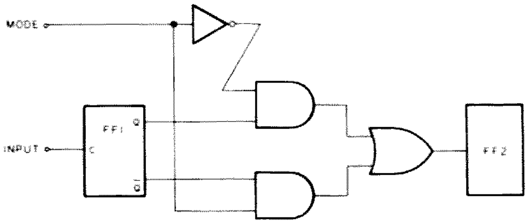


Fig. 15. A counter can offer the choice of up and down modes by adding logic.

A synchronous counter feeds the clock input to all flip-flops in parallel, and this results in a much faster operation.

Fig. 12 shows a partial schematic for a *synchronous binary counter*. We accomplish synchronous operation by using four flip-flops, with clock inputs tied together, and a pair of AND gates.

One AND gate is connected so that both Q1 and Q2 are HIGH before FF3 is active. Similarly, Q2 and Q3 must be HIGH before FF4 is made active. On a clock pulse, any of the four flip-flops scheduled to change will do so simultaneously. Synchronous counters attain faster speeds, although ripple counters seem to predominate in most applications.

Preset Counters. A preset counter increments from a preset point other than 0000. For example, suppose we wanted to count from 5_{10} (0101_2). We could preset the counter to 0101 and then increment from there.

Fig. 13 shows a common method for achieving preset conditions for the *jam* input. Only two stages are shown here, but adding two additional stages will make it a four-bit counter. Of course, any number of stages may be connected in cascade to form an *n* but preset counter.

In Fig. 13, the preset count is applied to points A and B, and both bits will be entered simultaneously when clock line CP2 is brought HIGH. Line CP2 is sometimes called the enter or jam terminal. Once the preset bit pattern is entered, the counter will increment from this with every transition of clock line CP1.

Down Counters. A down counter decrements, instead of incrementing, the count for each excursion of the input pulse. If the reset condition is 0000, then the next count would be 0000 −1, or 1111 (it would have been 0001 in an up counter).

We use basically the same circuit as before but toggle each FF from the NOT-Q rather than Q of the preceding FF. An example of a four-bit binary down counter is shown in Fig. 14. Note that the outputs are taken from the Q outputs of the FFs but that toggling is from the NOT-Q.

The preset inputs of the flip-flops are connected together to provide a means to preset the counter to its initial (i.e., 1111) state. This counter is also called a *subtraction counter* because each input pulse causes the output to decrement by one bit.

A decade version of this circuit is shown in Fig. 14(b). As in the case of the regular decade counter, a NAND gate is added to the circuit to reset the counter following the 10th count. We detect the states where outputs C and D are HIGH, and then clear the two middle FFs. This action forces the output to 1001_2 (i.e., 9_{10}). The counter then decrements from 1001 in the decimal sequence 9-8-7-6-5-4-3-2-1-0-9 etc.

Up/Down counters. Some counters will operate in both up and down modes, depending upon the logic level applied to a *mode* input. Fig. 15 shows a representative circuit in which the first two stages of a cascade counter are modified by the addition of several gates. If the mode input is HIGH, then the circuit is an up counter, but if the mode input is LOW, then the circuit operates as a down counter.

Conclusion

This three-part series has offered you the basics of digital electronics. With this information, you should be able to conduct a large number of experiments, build most of the simple-to-moderate-difficulty digital projects published in this (and other) magazines, and even design a few circuits. From here, let me recommend that you begin to study microprocessors and microcomputers. From the radio amateur's point of view, interfacing is very important. ■

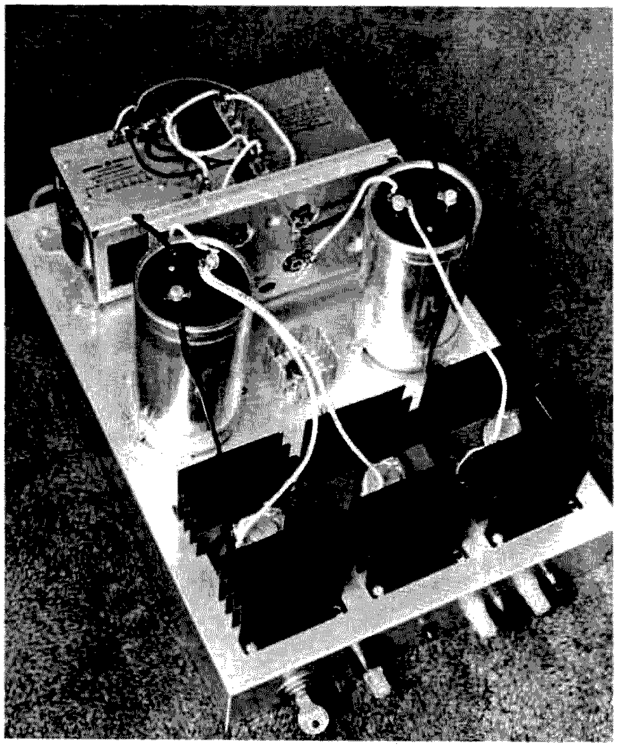
Kenneth D. Wyatt WA6TTY
SK Electronics
10672 Woodbury Rd.
Garden Grove CA 92643

The Money-Maker Power Supply

Need 12 volts for your transceiver? Save half the cost of a commercial unit by assembling this 25-Amp monster.

Since the advent of solid-state transceivers, there has been the need for a simple high-current 12-volt power supply. The power supply described in this article will produce 13.8 volts at up to 25 Amps continuous duty. All the parts should be readily available.

First of all, you will need to determine how much current your transceiver draws, and at what voltage. Look up the current drain during transmit in your owner's manual. For a 100-Watt radio, this may be about 20 Amps. Most transceivers, whether they be small two-meter radios or large multiband 100-Watt HF ones, will have a voltage rating of 13.8 volts. This seems to be an industry standard. Thus, if you were to build a 12-volt supply, you probably would not achieve the full rated power output.



The completed 13.8-volt, 25-Amp supply includes overvoltage protection.

Once the voltage and maximum current are determined, you may choose a transformer. If it is not possible to find one of the proper ratings locally, then try requesting catalogs from the following three companies. They all seem to have a large stock of transformers at good prices.

- Delta Electronics
  PO Box 2
  Amesbury MA 01913
  (617)-388-4705
- Fair Radio Sales Co.
  PO Box 1105
  Lima OH 45802
  (419)-227-6573
- Meshna
  PO Box 62
  Lynn MA 01904
  (617)-595-2275

A minimum of 13.3 volts rms must be supplied to the filter for a regulated output of 13.8 volts. This is equal to the desired output voltage plus five volts divided by 1.414. The current rating, of course, must be greater than or equal to the desired output current. In my case, the required current was 22 Amps at 13.8 volts. Thus, the transformer should have a current rating of at least 22 Amps and the secondary rms voltage should be *at least* 13.3 volts (13.8 + 5)/1.414. I chose, from the Meshna catalog, a 15-volt, 15-Amp autotransformer. The stock number was T-658 and the price was eight dollars. I bought two of them to put in parallel for a total of 30 Amps. Meshna provides instructions to convert these autotransformers to regular transformers. This just involves rewiring of the attached terminal board.

While you are looking through the catalogs, keep an eye out for some high-current rectifiers, large heat sinks for both the rectifiers and the pass transistors, and some "computer-

grade" capacitors. See the parts list for the values. Also, please note that in most cases, the values in this power supply are not very critical. As long as they are close, they should work. Most of the smaller parts are available at Radio Shack. In these cases, the part numbers are shown as RS numbers.

Circuit Description

The circuit is a full-wave bridge rectifier with a linear regulator. See Fig. 1. The voltage regulator consists of an LM317 which provides base drive for the pass transistors. The LM317 is an adjustable three-terminal voltage regulator that when supplied with 27 volts on its input can provide an adjustable 1.2-to-25 volts at 1.5 Amps. In this case, we will be inputting 15 volts times 1.414 or 21.2 volts (peak) from the rectifier/filter combination. The regulator output voltage must be 13.8 volts plus the base-emitter drop of the pass transistors. This will be 13.8 volts + 0.7 volts, or 14.5 volts.

Three pass transistors are used and they share the output current equally. There are several options for overvoltage protection and these will be discussed towards the end.

Circuit Blocks

Each section in the block diagram will now be described. When doing the actual construction, build one block at a time and test it as you go. This will save debugging time and may prevent burned out parts. Build them in this order:

1) Power transformer, rectifiers, filter capacitors, and 117-V ac input circuit.

2) Voltage-regulator circuit (LM317).

3) Pass-transistor circuit.

4) Output-protection circuit.

Note that the power supply can be used without any protection circuit, but you must be very careful of short circuits. It is possible to lose the supply *and* the radio with one mistake!

Transformer Circuit

The transformer circuit consists of the line cord, fuse, pilot lamp, transformer, rectifiers, and filter capacitor. See Fig. 2. Get yourself a heavy-duty line cord for this power supply as you may be drawing 3 to 4 Amps on the transformer primary. A three-wire cord is preferred and the green or ground wire should be connected to the power supply chassis.

Use a 5- to 10-Amp fuse for the primary circuit and a small neon lamp with built-in series resistor for the pilot lamp. I used a key lock for the On-Off switch to prevent "unauthorized" use.

First, mount and wire the transformer(s) and line cord to the chassis. Connect the switch, pilot lamp, and fuse to the primary circuit. Then mount the rectifiers to the rectifier heat sink and mount the assembly near the secondary side of the transformer. Use at least number 12 or, better, number 10 house wiring to wire all the secondary circuits, rectifiers, and pass transistors. The rectifiers must have mica insulators so they won't short out through the heat sink. Also, a layer of silicone thermal grease should be applied between the rectifiers and the heat sink. Extra grease should be wiped off after the rectifiers are bolted down. The rectifiers will have a voltage drop of about one volt at 25 Amps, so the power they must dissipate will be: 1 volt times 25 Amps at a 50% duty cycle = 12.5 Watts each. Make sure the heat sink is a large one.

Next, mount the filter capacitor(s). Use heavy gauge wire for the capacitor(s), too. Now, recheck all wiring

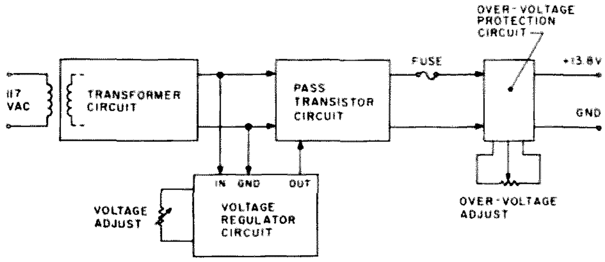


Fig. 1. Block diagram of the complete power supply. Each section is discussed separately. There are three options for the overvoltage protection circuit.

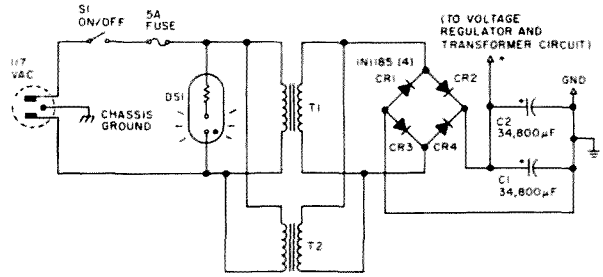


Fig. 2. Schematic diagram of the transformer section. The transformers are rated 15 volts at 15 Amps.

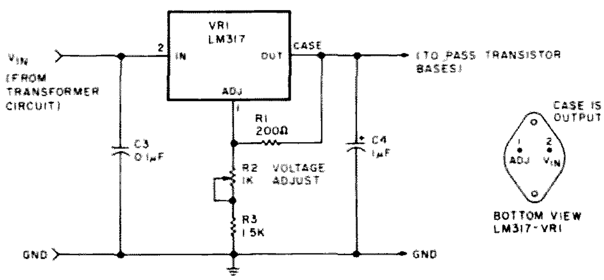


Fig. 3. Schematic diagram of the voltage regulator. R1 can be 200 to 250 Ohms. All resistors are rated at 1/2 Watt. C3 is a ceramic and C4 is electrolytic. Both should be mounted as close to VR1 as possible.

against the schematic. Make sure that the switch is off and plug the line cord into the wall socket. Be careful of any primary transformer connections as there will be 117 V ac there. Connect a voltmeter set on the 50-volt scale to the filter capacitor terminals and turn the power on. You should measure an unloaded voltage of about 15 volts times 1.414 = 21.2 volts dc. Record your voltage reading, as we will be using it for some power calculations later. Make sure the On-Off switch works and that the pilot light works with the switch. Note that since there is nothing connected to the filter capacitor terminals to bleed off the voltage stored there, it might be wise to connect a 1000-Ohm, 1/2-Watt resistor across the terminals before continuing. Turn the power off and use your voltmeter to verify that the voltage is near zero.

Voltage Regulator Circuit

Now start construction of the voltage-regulator circuit. See Fig. 3. Mount the LM317 regulator to the chassis using a small TO-3 heat sink. Use some silicone

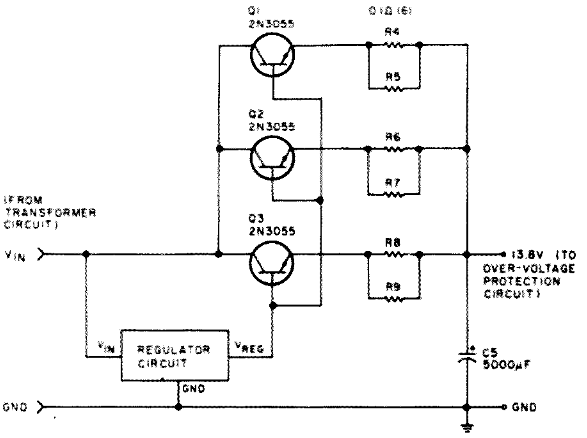


Fig. 4. Schematic diagram of the pass transistor section.

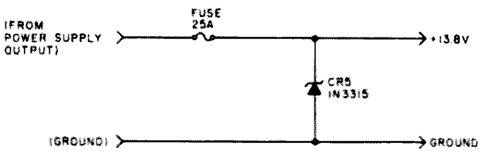


Fig. 5. Option 1 overvoltage protection circuit.

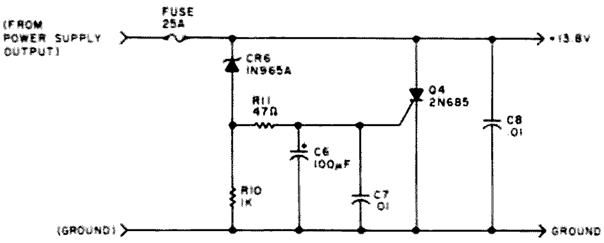


Fig. 6. Option 2 overvoltage protection circuit.

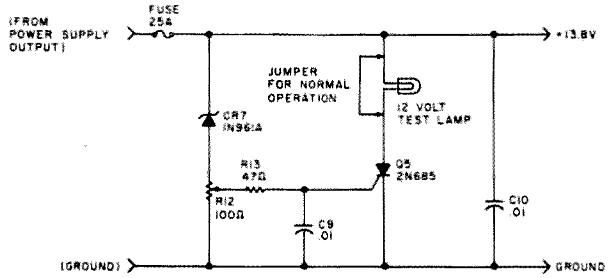


Fig. 7. Option 3 overvoltage protection circuit. This version has an adjustable voltage-limit point.

grease and be sure to use a mica insulator because the regulated output voltage is connected to the case. To determine the power dissipation of this regulator, take the unloaded voltage reading you took earlier and subtract 14.5 volts. Then multiply by 1.5 Amps. In my case, the power dissipated was: (21.2 volts minus 14.5 volts) times 1.5 Amps = 10 Watts. The heat sink must be large enough to dissipate this power.

Mount the voltage control pot on the top or the front of the chassis. Finish wiring the regulator circuit using point-to-point methods. Here, you can use smaller gauge wire since the highest current will only be 1.5 Amps. Now connect the regulator input to the positive terminal of the filter capacitor. Make sure that the negative terminal of the filter capacitor is grounded to the chassis.

Temporarily connect a 10- to 50-Ohm, 10-Watt resistor across the voltage regulator output to act as a load. Connect a voltmeter across this load resistor and set the voltage control to the midway point. Turn on the power and verify that you are getting about 11 to 17 volts as the voltage-control pot is adjusted. If the output does not vary with the control, double-check the wiring to the LM317.

Pass Transistor Circuit

If everything is OK so far, the next step is to mount the pass transistors. See Fig. 4. Use large TO-3 heat sinks and mount the transistors using mica insulators and silicone grease. Be sure to drill holes in the chassis for the wires to the transistors. Use rubber grommets.

To determine the maximum power dissipation of the pass transistors, you will need the unloaded voltage you measured across the filter capacitor. Take this voltage and subtract 13.8 volts. Then multiply this by one third of the total output current. In my case, the power dissipated in each transistor was (21.2 volts minus 13.8 volts) times (22 Amps/3) = 54.3 Watts. Make sure that the heat sinks are large enough to dissipate this much heat. I found that a finned heat sink of about 3" times 4" times 2" was alright.

After the transistors are mounted to the chassis, connect all the bases together and run a wire from there to the voltage-regulator output. Small gauge wire is OK. Connect two 0.1-Ohm, 5-Watt resistors in parallel and solder one end of this to one of the emitters. Connect the other four resistors likewise. Finish the rest of the pass-transistor sections using 10- or 12-gauge wire for the emitter and collector terminals, the connections to the filter capacitors, and to the output terminals of the power supply.

Verify all wiring completed so far and then connect a 1- or 2-Ohm, 200-Watt resistor across the power supply output (you'll probably have to combine several resistors to get one of these). Connect a voltmeter across this load resistor. Turn the voltage control to minimum. Stand back and turn the power on! If all goes well, you should see a voltage of about 10 volts. If you are using a load resistor of 1 Ohm, then it is drawing 10 volts/1 Ohm = 10 Amps. Try adjusting the voltage control and record the minimum and maximum voltages. These limits should bracket the required 13.8 volts. Make sure that the maximum power supply voltage will not exceed the trip-point of the overvoltage protection circuit. Otherwise, it will trip and you will lose a fuse. If you choose not to install a protection circuit, you may lose a radio!

Output-Protection Circuit

It is surprising how many commercial power supplies, including those of various ham manufacturers, do not incorporate some form of overvoltage circuit. The following are three options that will work. All use some method of sensing an overvoltage condition and then clamping or "shorting" the power supply output, thus blowing a high-current fuse.

The first and simplest option is to use a zener diode directly across the output. See Fig. 5. Choose a zener voltage of about two volts over the normal power supply voltage. The current rating should be greater than that of the power supply so

the fuse, rather than the zener, will blow. The current rating of the fuse should be between the power supply output current and the zener current rating. For example, for this power supply, choose a 25-Amp fuse and a 16- or 17-volt, 50-Watt zener.

The disadvantage of this circuit is that it is not adjustable and there still may be a chance that the zener will blow first before the fuse. This will still protect your radio, because when zeners fail, they usually stay shorted and this will reduce the overvoltage to near zero.

The second option is also not adjustable. It is an SCR (silicon-controlled rectifier) crowbar circuit. This circuit was published by Tom Lawrence WB4QLW in *73 Magazine,* August, 1977. This is the one I used for my power supply because it is fairly simple and the parts are readily available. See Fig. 6.

Here is how it works: As the power supply output starts to increase from normal and reaches the zener voltage, the zener will start to conduct current. This current will produce a voltage drop across the 1000-Ohm resistor and trigger the gate of the SCR. When the SCR becomes triggered, it will latch on and short the power-supply output, thus blowing the fuse. It is really not necessary to heat-sink the SCR since the shorted condition will last only as long as it takes for the fuse to open. Make sure that the maximum adjustable output voltage is less than the zener voltage rating.

The third and last option is similar to the previous except that the crowbar voltage is adjustable. See Fig. 7. This circuit was published by Joel Eschmann K9MLD in *73 Magazine,* August, 1979.

The operation is the same, except the trip-point can be adjusted from the zener voltage rating upwards. To test this circuit, break the connection between the anode of the SCR and the positive output line. Insert a 12-volt lamp in series as shown. Adjust the voltage control for maximum voltage and adjust the overvoltage control to maximum (wiper all the way toward the ground end).

Turn on the power supply. The test lamp should be off. Start turning the overvoltage control until the lamp just turns on. Now turn the control about 1/8 to 1/4 turn back in the other direction. This will add a small buffer zone. The lamp should still be on. Now turn the power supply off and then on again. The lamp should stay off. If the lamp is still on, try the adjustment again.

Try turning the voltage-adjust control from maximum to minimum and then back to maximum. The lamp should remain off. If so, all is well. Note that to turn off the lamp it is necessary to reset the SCR by momentarily turning off the power supply. When the crowbar is adjusted correctly, remove the lamp and reconnect the anode of the SCR back to the positive output. Now, when the overvoltage reaches the trip-point, the SCR will turn on and blow the fuse.

Parts List

Item	Qty.	Item	Buy at	Approximate Cost
C1, C2	2	34,800 μF, 50 V ea., or equiv.	Meshna	$ 5.00
C3	1	0.1 μF	RS272-0135	$ .39
C4	1	1 μF	RS272-1055	$ .89
C5	1	4700 μF, 25 V	RS272-1022	$ 3.59
CR1-4	4	1N1185, 150 V, 35 Amp	Meshna	$ 4.50
DS1	1	Neon lamp w/series resistor	RS272-0706	$ 2.19
Q1-Q3	3	2N3055 or equivalent	RS276-2020	$ 5.97
R1	1	200 to 240 Ohms, 2 W	RS271-0135	$ .89
R2	1	1000-Ohm potentiometer	Meshna	$ 1.00
R3	1	1.5k, 1/2 W	RS271-0025	$ .19
R4-R9	6	0.1-Ohm, 3 W, or equivalent	Meshna	$ 1.00
S1	1	SPST switch, 5 A contacts	RS275-0603	$ 1.49
T1, T2	2	15 V, 15 A transformer or equivalent	Meshna	$16.00
		Option 1 Parts		
CR5	1	16 V or 17 V, 50 W zener (1N3315)		
		Option 2 Parts		
C6	1	100 μF, 35 V	RS272-1016	$ 0.79
C7, C8	2	0.01 μF	RS272-0131	$ 0.29
CR6	1	15 V, 400 mW zener (1N965A)		
O4	1	50-100 V, 16 A SCR (2N685, 2N1844, 2N4441)		
R10	1	1000 Ohms, 1/2 W	RS271-0023	$ 0.19
R11	1	47 Ohms, 1/2 W	RS271-0009	$ 0.19
		Option 3 Parts		
C9, C10	2	0.01 μF	RS272-0131	$ 0.29
CR7	1	10 V, 400 mW zener (1N061A)		
Q5	1	50-100 V, 16 A SCR (2N685, 2N1844, 2N4441)		
R12	1	100-Ohm potentiometer		
R13	1	47 Ohms, 1/2 W	RS271-0009	$ 0.19

Conclusion

This completes the construction of the basic power supply. If you wish, you may add a voltmeter and an ammeter. You also may wish to make and install a cover to dress up the chassis.

The voltage adjust and overvoltage-protection adjust controls may be placed anywhere out of the way. If you plan to use this supply in a dedicated application, the controls, once set, may be left alone.

If you will be using the supply at various voltage levels, I would suggest option 1 or 2 for your protection circuit. That way, there will be less chance to misadjust the overvoltage control and, consequently, less chance of blown fuses.

So, enjoy your new power supply and, at the same time, observe normal precautions while using its high-current capabilities. Also, if you have a well-stocked junk supply, just think how much you will have saved over a commercial supply! If you have any questions, please send an SASE for a reply. Have fun! ■

TVRO Q & A: Part III

LNAs are expensive, but rolling your own is a losing proposition.

Ken Rae WBØPOP
737 South Clarkson
Denver CO 80906

What is the purpose of an LNA?

The purpose of an LNA is to amplify the signal collected by the feedhorn (approximately 4 microvolts) to a usable level without adding any appreciable noise.

Are all 120-degree LNAs the same?

No, they are not. Some manufacturers meet the specifications by just a bare margin, and other manufacturers give you a 100-degree LNA yet call it a 120-degree LNA because it's sort of a stepping stone; you buy either a 100 or 120. There are some indications that manufacturers will include a 105-degree LNA as a step in progression of degrees Kelvin.

Is the LNA's bandwidth important?

A few years back it was said that the bandwidth of many LNAs was too wide for TVRO application. Since then most of the manufacturers have installed bandpass filtering to narrow down the amount of outside noise that could come in. We don't want the whole world walking through the LNA. We would like to amplify the TVRO frequencies exclusively.

Should I buy or build an LNA?

I recommend that you buy your first LNA. I've seen only 10% of the people who try to construct an LNA actually succeed and build something that is worth having. The disasters are horrible, so if you build an LNA, do it after you have bought one. Buy one, put your system up, get it running, and then go back and construct a low-noise amplifier for your own use and education. Then you can sell your commercial LNA for the same price you paid for it.

How hard is it to build an LNA?

An analogy would be if you went down and got plate-glass sheets and tried to grind your own zoom lens for a 35mm camera. You can just imagine the precision required to do this and to add optical coating that you would have to put on for color pictures. Well, you're trying about the same thing when building an LNA.

What is the most misunderstood thing about building an LNA?

That it is much like HF work or the old tube work clear back into the fifties, where you could simply insert a tube or transistor and turn the machine on to see it run. GaAsFETs have a very critical LC reactive component to their nature, and if these parameters are not met the transistor will not perform. Meeting these parameters is difficult and takes a lot of time and meticulous work. There are people who claim that they can throw transistors into a stripline design and learn the recipe for creating a low-noise amplifier. In some cases this does work. But as a general rule, the misconception is that you can put it together, turn it on, and it will run for you. I have never seen this first try, first serve situation.

Why are LNAs so expensive?

Profit is one reason, but in past years they've been extremely expensive because 20% of the LNA cost is materials and the rest is labor, much of which is because a design engineer or a microwave engineer has to sit and tune the LNA for proper specifications. This is extremely expensive at the rate of pay for engineers. The common laborer on a construction test bed is not able to bring a low-noise amplifier to specifications by simply plugging in the transistor, soldering it down, and shipping it out. It has to be tuned with precise instruments. The prices are dropping now, however, and they have come down almost two-thirds in the last 3 years.

Will the open-end LNA work with no feedhorn?

Yes, it will. You can take the common commercial LNA with the open mouth and omit the feedhorn; this works exceptionally well for a .3 to a .4 dish. Now, if you go much larger than a .45 or .5 dish, where they're flatter, then you'll want some sort of a funneling device on the front of your horn such as a square-flanged horn or a funnel to create a more directional beam from the focal point to the dish.

Is a 60-dB LNA better than a 30-dB LNA?

No, I wouldn't say so, not in natural use if the mixer is within the vicinity of the low-noise amplifier. If you're going to put your mixer inside the house and run 60-80 feet of coax or heliax to the mixer, then you need some extra dBs from your LNA and gain to pump the signal down the coax, but in effect they're equal in quality. A lot of people will think a 60-dB gain is better than a 30-dB gain. As far as the noise level goes, that is established by the first transistor amplifier of the GaAsFET LNA, and therefore stages added behind it do not improve the noise figure. They improve the ability of the low-noise amplifier to push the rf further down the coax without getting back down to an unworkable level at the other end of the coax.

My LNA works all right at night, but is very noisy during the day; why is that?

It sounds like you have a heat problem inside the LNA where the chip capacitor is separating and/or closing due to the heat and expansion of the circuitry. Normally the day and night transition is not noticeable on a TV screen unless you're a very particular person and see more sparklies during the day than you do at night. But if this is the case, it's usually due to the temperature of the LNA, and its circuitry is failing during the day. The other type of interference that comes during the day is unassociated with temperature, light, or conditions of the sunspot cycles. The satellite noise figure is due to its position relative to the sun on its receiving antennas and whether it's charging its batteries or not. And all these parameters influence noise during the day.

One of the biggest clues to terrestrial interference is the fact that it's usually more predominant during the day than at night due to the fact that telephone traffic is a lot heavier during the day. The deviation is higher due to the volume of FM traffic that is coming out of the terrestrial interfering signal and deviates further into the video portion of the band of the particular channel that you're watching. Therefore, you'll notice the interference is heavier during the day than it is at night. If around 9 or 11 o'clock at night, when telephone volume drops off, the TV gets more and more clear, then you can suspect that you have terrestrial microwave interference, and I would go look for it with a spectrum analyzer at that point.

What is a dc block and is it really needed?

Yes, most of the commercial LNA manufacturers require that the dc power for the LNA be fed through the coax from the center conductor—this being a plus 15 to a plus 28 volts in some applications. In order to put the dc onto the coax going up to the LNA and at the same time have the rf from the LNA coming down that coax, you must divorce the two from each other at the mixer. A dc block is simply a capacitor, usually in the neighborhood of 1000 pF, inserted into the signal path allowing the rf to go through but keeping the dc on the LNA side of the stripline. An rf choke in the neighborhood of 5.6 or 10 millihenries is used to divorce the rf from the dc bias line that comes from the house. This enables you to have just one cable going to the LNA.

Do holes in the waveguide hurt anything?

It depends on how large the holes are. If they're no larger than one-eighth to one-quarter inch, they don't have very much effect if there are only one or two in the waveguide. I have quite a few holes in the home-built waveguides that I've used and I can see no difference whether I leave them open or cover them.

Do waveguide flanges have to be airtight?

The only reason that you would need an airtight or sealtight flange between waveguide joints is to make sure that you don't interfere with another system. If you have a high-power oscillator feeding down one of these waveguides or if you were receiving side interference from terrestrial microwave or something of this nature, then airtight flanges are needed. At the low level of signal that we are talking about, the normal, compressed, bolted-together waveguides are extremely efficient. The amount of enhancement gained by goldplating, sealing, soldering, and shimming the flanges is nearly useless. Moisture seepage or air seepage might be another consideration if you're having condensation problems inside your waveguide, but most waveguides are open. My waveguide is open and has been for three years.

How much gain is necessary for a "perfect" picture?

For a perfect picture, something in the neighborhood of 30-36 dB is usually needed. The LNA output must be sufficiently strong to drive the mixer stage. The mixer diodes, if not driven properly, will add appreciable noise to the system. This dictates about 33-dB minimum.

Why do some people use round horns and others use square horns?

A long time ago it was understood that you get an easier impedance match and less loss with a square horn. I'm not sure whether that is true, but square horns do have one distinguishing factor: The pick-up probe and the impedance matching tend to be consistent in single-mode operation. Hence the square waveguide is heavily used in military and commercial applications.

Circular waveguides collect an equal amount of E and H fields, these being perpendicular to each other. That is, when the wave enters the dish, the E and H fields are perpendicular. The E field is the electrostatic field and the H field is the magnetic field; therefore, in getting the maximum power transfer, you must have an equal amount of these two properties.

The circular waveguide more readily matches the configuration of the circular parabolic dish, the spherical dish, and also the wavefront you are trying to receive. The circular waveguide is therefore more receptive to the incoming wave than the square waveguide. In summation, the circular waveguide outdoes the square waveguide by approximately 1 to 1.5 dB. However, the transition that you use may cause a loss of .5 to 1 dB, so you may not gain anything by going from circular to square, depending on how well your transition works.

Why use a horn instead of a dipole?

The dipole by itself does not have the gain. What you are trying to do is focus the waves onto the probe in the rear of the waveguide. This gathering of the waves is extremely valuable when you're working with small signal levels of TVRO.

What is a scalar horn?

A scalar horn is simply an rf choke that keeps the signal from going over the outside of the waveguide or feedhorn and traveling back out toward the satellite. It also represents a sort of yagi antenna; a scalar horn's ribs re-radiate the wave toward the center of the waveguide, acting as an electrical funnel that catches and shoves the wave into the mouth of

the waveguide. The scalar horn applies most readily to a deep dish—low focal-distance-to-diameter ratio (F/D). The horn must "look" at a wider angle. The funnel-shaped horns are more directional and are used with a flat dish.

Why is the spherical-dish horn so much larger?

The focal point of a spherical dish is quite a long distance from the surface of the reflecting spherical and therefore a larger area has to be gathered in. It is as if you are traveling 12, 14, or even 32 feet away from the spherical antenna to catch the microwave signal. You're sort of like a catcher in a baseball game; you want to use a large glove to catch that little ball. The further away you are, the more directional you want your view of the antenna. Therefore, the broader the horn is, the narrower the beam is. So you want to catch this narrow beam, making the horn appear much larger in physical size. The diameter of the mouth is much broader than for a parabolic dish.

What horn do you use on a .3-F/D dish?

On a .3 you would use a wide-angle horn such as a sawed-off waveguide, a sawed-off piece of 2-inch pipe, or a rectangular commercial 229 waveguide. The waves spread very rapidly as they leave the mouth of the horn. This leads us to use the scalar horn as the best choice.

Is a gold- or silver-plated horn better than a copper one?

Gold or silver is better, but for all the cost of having the gold plating or the silver plating done, you will probably increase the signal only a tenth of a dB. So it's cost prohibitive to do this type of thing.

Are there any surplus horns?

"Surplus" is not really the word because you can go to any plumbing shop and find a 2-inch diameter circular piece of downspout copper tubing—and that is your "surplus" waveguide. There are square and rectangular waveguides. An abundance of them are being thrown out every month by AT&T into scrap yards where they're sold for scrap copper. (They knock off the brass fittings on the ends of the flanges for brass scrap.) There are probably tons of this lying around all over the United States.

How thick should the walls of the horn be?

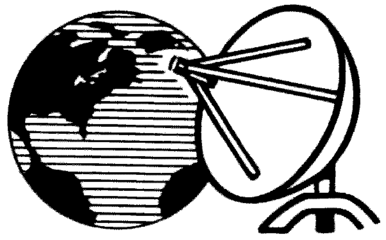
Thick enough to withstand abuse such as from dropping it or from wild weather. In mounting it, you might bang into it, so you don't want it to distort readily with normal handling. Something like 24-gauge or 28-gauge copper is the thinnest you should use to make it rigid.

Can you use PC material for the horn?

I don't like to use PC board material because you solder to only one side at a time, leaving only thin copper to hold the corners together. Bracing it on the outside takes extra work such as putting brackets around it to hold it together. Generally speaking it will work reasonably well, although I think there's easier material to work with.

Where can I buy a horn?

That, I wouldn't know. Most horns can be built readily out of sheet copper drawn out on the kitchen table, cut with a pair of tin snips, folded, and soldered together, just as you would fold up cardboard to make a box for Christmas wrapping. Most of the amateur enthusiasts construct their own horns. ■



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Tony Ruepp HB9BLU
Ifangstr. 73
CH-8153 Ruemlang
Switzerland

The TS-180 contains a very effective swr protection circuit. If ever the swr exceeds a given limit, this circuit immediately cuts off your transmission and lights the LED. This state is held until you (or the VOX) release the transmit button.

When transmitting CW, I very seldom watch the rig. I rather "see" the letters and words passing by while staring at a hole in the air. Several times I did not realize my transmission had been cut off, but I learned it immediately when I returned to receive and heard my partner in another QSO wondering where I might have gone. My 40m and 80m antennas swing in the wind and often exceed the swr limit for a moment.

The following very simple modification guarantees gaining your immediate attention whenever the protection circuit has fired. It simply steals the sidetone and even recycles the protection circuit if you're operating in the VOX mode. It's an easy job to do (takes about 15 minutes and costs less than a dollar) if you follow the instructions carefully:

Prepare a diode (1N4148 or equivalent) and a piece of insulated wire (length about 50 cm). Strip one end and pre-tin it.

1) Remove the eight screws which secure the top cover.

2) Lift the cover slightly and unplug the speaker.

3) Remove the cover entirely.

4) Locate the protection-circuit LED above the digital frequency display. This LED is mounted on the LED unit. The leftmost pin on it is labeled PRL and a blue wire is soldered to it.

5) Make sure no other wires are touching that pin, then solder the prepared wire to it.

6) Bend the wire 1.5 cm behind the pin to the left. Bend it to the rear again after another 3 cm and follow the edge of the PLL assembly to the rear of the rig.

7) Bend it to the right again and cut it 2 cm from the CW key jack.

8) Strip ¼ cm and tin it.

9) Now carefully place the wire in its proper position and tape it close to its end to the chassis.

10) The CW key jack has 5 soldering lugs. Locate the one with the brown wire. (This wire leads to the STS pins of the i-f assembly.)

11) Solder the anode of the diode to the lug with the brown wire and the cathode (ring) to the added wire.

This completes the modification. ■

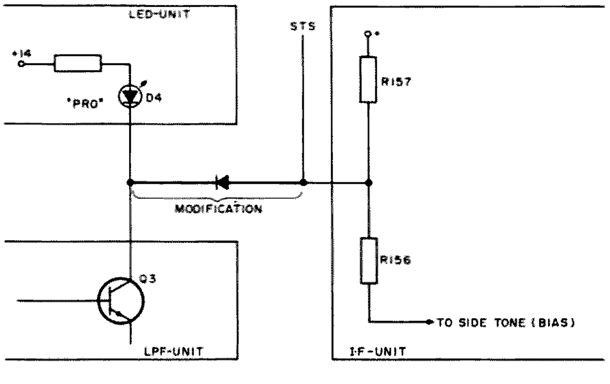

Fig. 1.

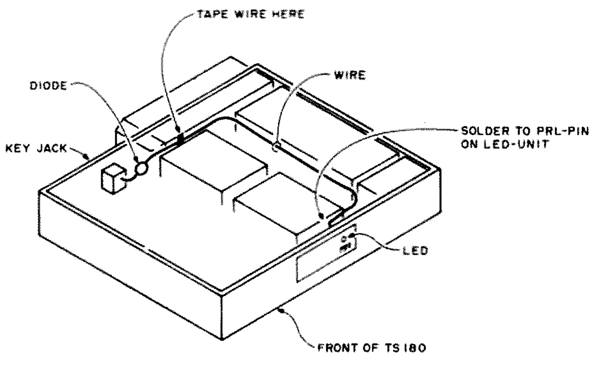

Fig. 2.

Reader Service for facing page ✓15→

Build the Re-Fuser

It's a self-replacing fuse.
Why blow one when you can blow two?

A. W. Edwards K5CN
456 Glenmore
Corpus Christi TX 78412

I am sure that many technicians have made a trip to a remote, unattended electronic installation to restore some piece of equipment to service only to find that the problem was an open fuse. When the fuse was replaced, everything was normal; no other defect was apparent.

This article describes a circuit which will detect the open-fuse condition, give the load and/or supply time to recover, replace the open fuse with a good one, and announce the fact that the reserve fuse is now in service.

Fig. 1 shows the general circuit for a dc-powered unit. So long as the regular fuse, F1, is good, the heater element of the time-delay device is shorted out by it. Should F1 open, the heater appears in series with the load. After a delay period for the thermal device to operate, the TD switch contacts close and power is applied to the gates of SCRs 1 and 2. SCR1 conducts and places F2 in the main load line. If the load now is capable of proper operation, F2 will hold, restoring the equipment to service. The TD heater is again short-circuited, so it resets.

SCR2 may be used to activate a small oscillator, e.g., a Sonalert™ or other type. This modulator can be made to signal, via an rf carrier, that the main fuse has failed and that the system is in the backup condition.

The modulating system may be a periodic beep or a continuous tone. The Sonalert device can give local aural notice, as well as providing electrical modulation.

A relay arrangement might also be employed, with the relay coil across the main fuse. ■

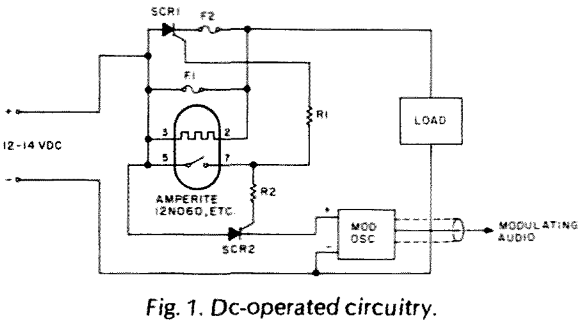

Fig. 1. Dc-operated circuitry.

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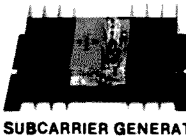

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This two- or three-component addition to a power supply will give the experimenter a visual indication of an over-voltage condition and do it for much less than the cost of a meter (see Fig. 1). All that is required is a low-power zener diode, an LED, and (possibly) a low-wattage resistor.

For example, in Fig. 1, the unregulated voltage is 18 volts. Since a voltage-regulator failure could occur if there were a collector-emitter short, there conceivably could be 18 volts at the power supply output. Suppose the load can't safely operate at that potential for very long. By choosing the right zener, the experimenter can have an inexpensive visual indication of this condition. The mathematics are simple!

Remember Ohm's Law? E = IR. For this example, a zener is chosen which will reduce the 18 volts by the 1.5 to 1.7 volts which are used to turn on the LED: $V_{zener} = 18 - 1.7 = 16.3$ volts. In a normal output voltage condition, the zener will not conduct and the LED will not turn on, but if the output rises to the breakdown value plus the LED conduction value, the LED will light. But suppose you don't have (in this case) a 16-volt zener. Maybe you only have a 13-volt zener. What then?

Well, 18 V − (13 V + 1.7 V) = 3.3 V. What is going to drop that 3.3 volts? Remember that resistor? Now you can use it. The resistance must equal that 3.3 volts divided by the current through the conducting LED, in this case .02 Amperes. Using Ohm's Law we get: R = E/I, or R = 3.3 volts/.02 Amps = 165 Ohms. This value of resistance is then placed in series with the LED and zener to drop the excess voltage (see Fig. 2).

If the voltage is required to be monitored exactly, then a meter is the better choice. But if an absolute over-voltage value is the only concern, then this circuit could be utilized for around $1.00. It could be a bargain. ■

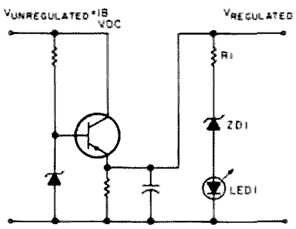


Fig. 1. R1, ZD1, and LED1 comprise the monitor circuit.

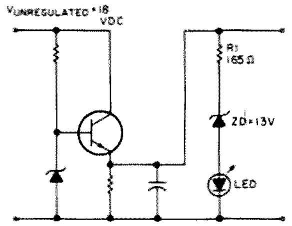
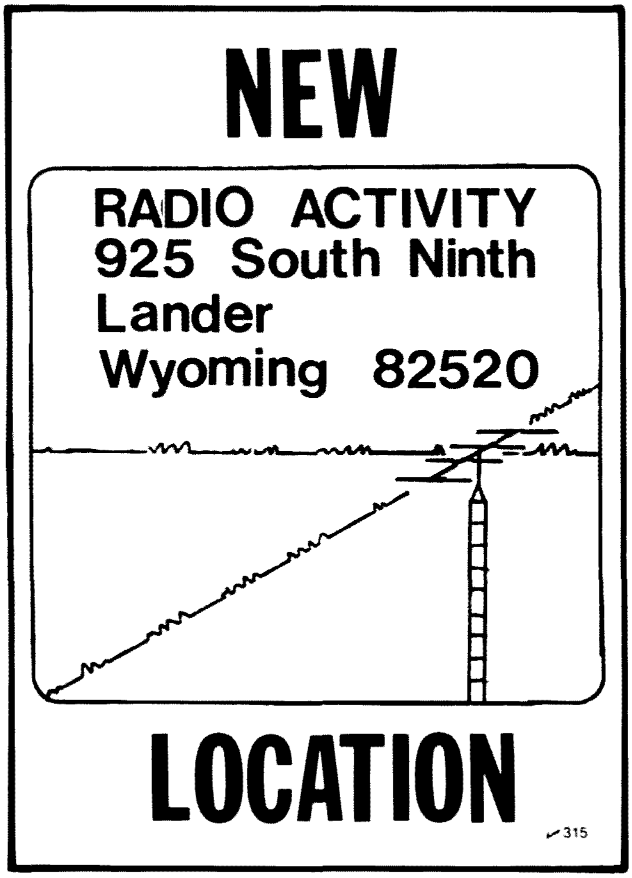


Fig. 2. The correct value for R1.



Tempo MARSer

Get the S-1 off those crowded ham channels. Expand your coverage above and below the amateur band.

Fig. 1. The Tempo S-1 transceiver.

Edison Fong WB6IQN
Signetics Corporation
811 E. Arques Avenue
Sunnyvale CA 94087

The Tempo S-1, introduced about two years ago, remains as one of the most popular VHF synthesized transceivers. This is because of its compact size, durability, reliability, and performance. This article will show that with some simple modifications, the radio's bandwidth can be extended to 140-155 MHz, thus covering MARS, mobile telephone, fire, police, etc. Although some degradation of performance occurs on the band extremes, no measurable degradation was observed within the amateur band. The few components and items needed are listed in the box.

The techniques presented here can be applied to similar transceivers such as the Icom IC-2A, but are much more complex with microprocessor-control radios such as the Kenwood TR-2400 and Santec HT-1200. Although the unit is capable of transmitting in the commercial band after the modifications, only authorized persons should do so. In addition, the modifications are not FCC-approved.

S-1 Background

The block diagram of the S-1 is shown in Fig. 2. The master oscillator is in a phase-locked-loop configuration so that only a single base crystal (6.82666 MHz) is used for the reference oscillator. This oscillator is fed through a programmable divider chip (NIS-103). Initially, this divider spans N=800-1600, giving the S-1 144-148-MHz capabilities. For example, the following divisions give the divider outputs and operating frequencies shown:

Division	Output (MHz)	Frequency (MHz)
N=800	1.33	144
N=1000	1.66	145
N=1200	2.00	146
N=1400	2.33	147
N=1600	2.66	148

NIS-103 does not directly divide the reference oscillator because NIS-105 contains other circuitry. The output signal is then mixed with the 43.1-MHz crystal oscillator. If the output of these two signals is summed and is fed through the vco consisting of the 2SK61 and then tripled via the 2SC1764, the output of the vco becomes 134.30 MHz. The vco generates the sum signal directly producing a clean signal as opposed to tapping the signal off the mixer

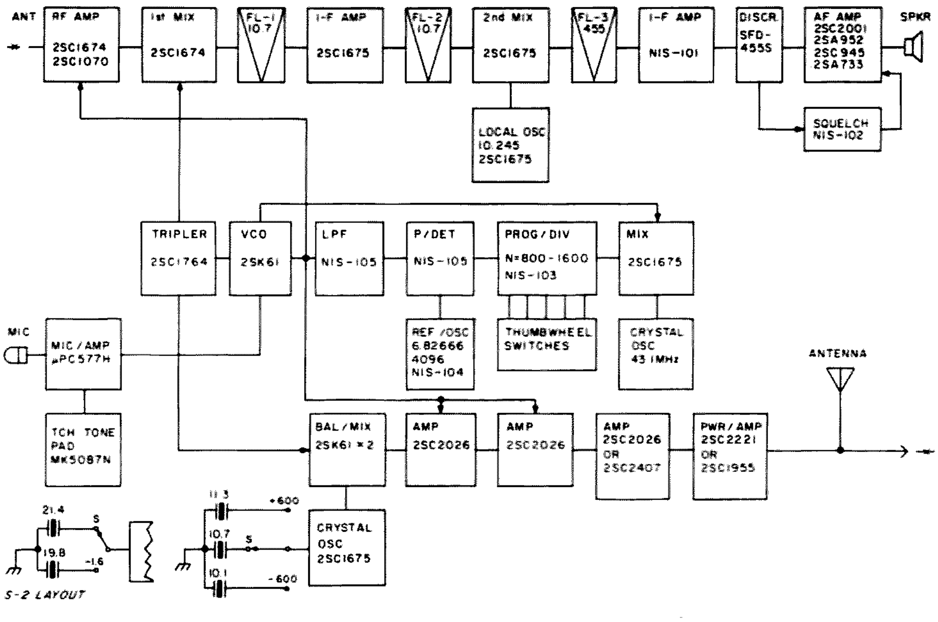


Fig. 2. Block diagram of the S-1.

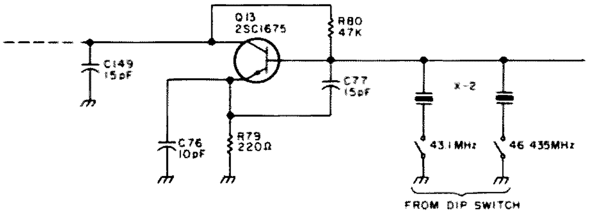


Fig. 3. Wiring configuration showing the switching of the two crystals.

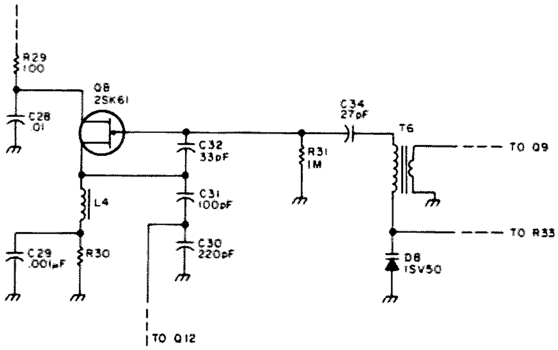


Fig. 4. Schematic of the vco. The only point at which the varactor diode can be connected is between C31 and C30 since the dc voltage will not disturb the circuit.

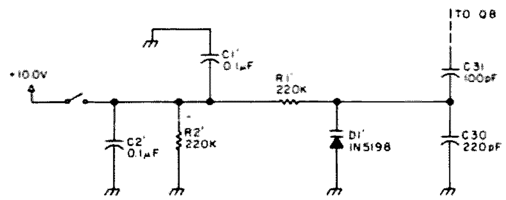


Fig. 5. Hookup of the varactor diode and how it is switched in and out of the circuit.

Fig. 6. Mounting of the varactor diode, C1', and R1' on the receiver board.

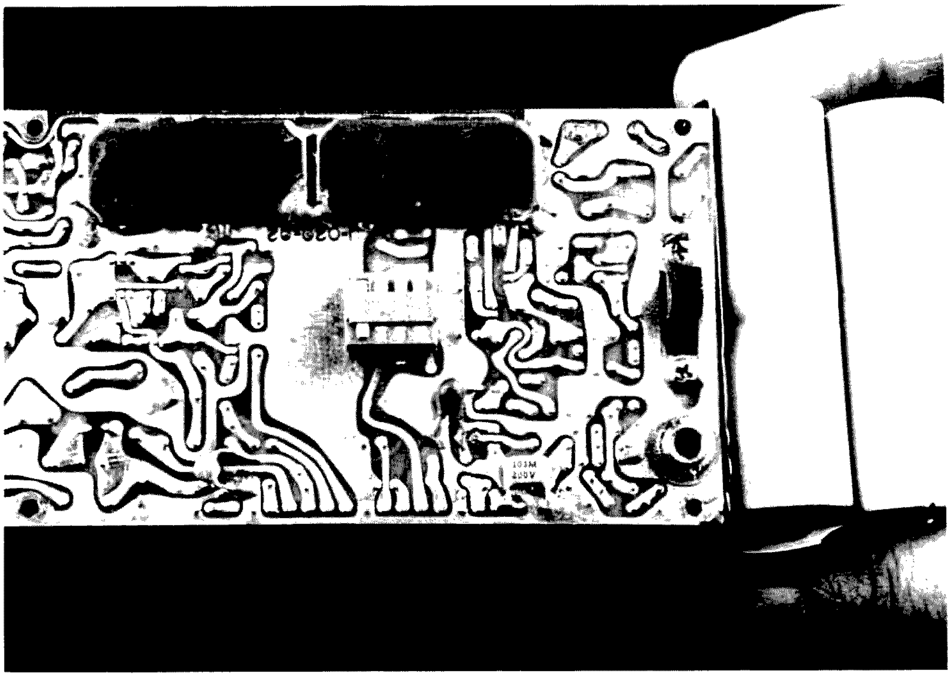


Fig. 7. Four-position switch mounted on the back of the transmitter board.

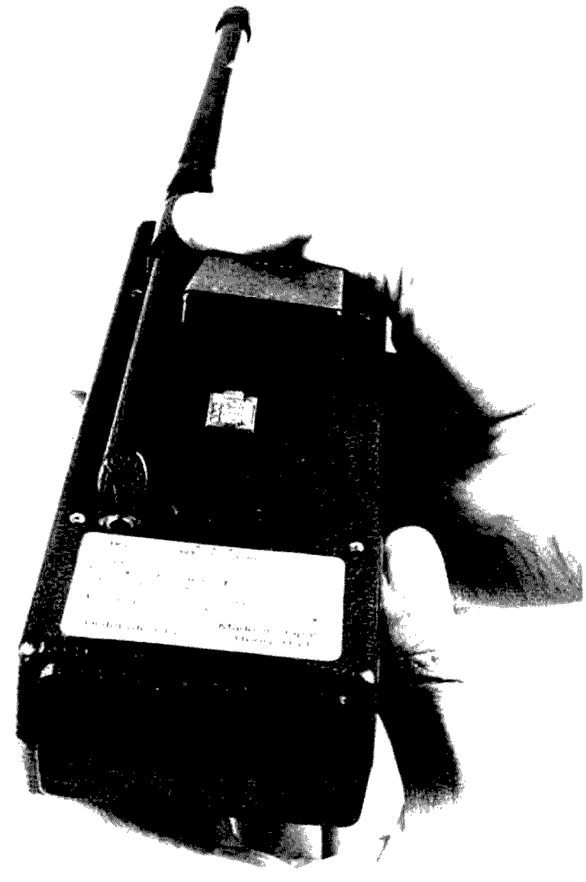


Fig. 8. The back of the transceiver showing the placement of the DIP switch.

(2SC1675), which will have spurious products within the band of operation. The two signals are compared by NIS-105 and a correction voltage is sent back to the vco (More on phase-locked-loop techniques can be obtained from Floyd Gardner's *Phaselock Techniques*, John Wiley and Sons, New York NY, 1966.) The signal is then fed either to the transmitter or receiver where 10.7 MHz is added on to it to obtain the 144.00 MHz shown in the example given above. For transmit offsets of +600 kHz, the crystal is 11.3 MHz, and for −600 kHz, the crystal is 10.1 MHz.

Extension to 140-150 MHz

The S-1 can easily be extended for operation from 140-150 MHz with minimum effort and no extra components. The programmability of NIS-103 is capable of N=0-2000. What prevents this action is not the electronics but the mechanics. Henry Radio is obligated to allow the radio to transmit only in the amateur band. This is done by placing rubber stoppers on the MHz section of the thumbwheel switches. With the unit removed from the housing, the three-section switch separates easily. On the switch furthest to the left, there are two rubber stoppers. Remove these and repack the switch. Coverage is now available from 140-150 MHz. Because of the varactor-tuned circuits in the transmitter and receiver, degradation in performance is minimal. With a dummy load into a Bird wattmeter, transmit power is still 1.5 Watts, and sensitivity is below 1 uV at the new band edges. No degradation was measurable within the amateur band.

Generally speaking, there is limited activity below 144 MHz, but from 148-150 MHz there is military, MARS, paging, and other action.

Extending the S-1 to 155 MHz

Most people would agree that 148-150 MHz is not where the major activity occurs. However, from 150-155 MHz, there are mobile telephone, paging, fire, police, ambulance, and other activities. A practical method of alternating the frequency is to change the 43.1-MHz oscillator crystal (X-2) to 46.433 MHz. This crystal will switch the synthesizer range to 150-160 MHz with direct readout. Unfortunately, the vco is capable of locking up only to 155.00 MHz. (This limit will vary from unit to unit.)

To switch the two crystals in and out of the circuit, remove X-2 and place it where the private line (PL) circuitry normally would go. Using RG-178 B/U (or RG-174, which is bulkier), connect one end to the receiver while the other end goes to the two crystals (43.1 or 46.433 MHz). For switching, a 4-position SPST DIP switch can be used. Since the crystal is grounded on the other end, it is best to disable the crystal by ungrounding it. Fig. 3 shows the wiring configuration. With the new

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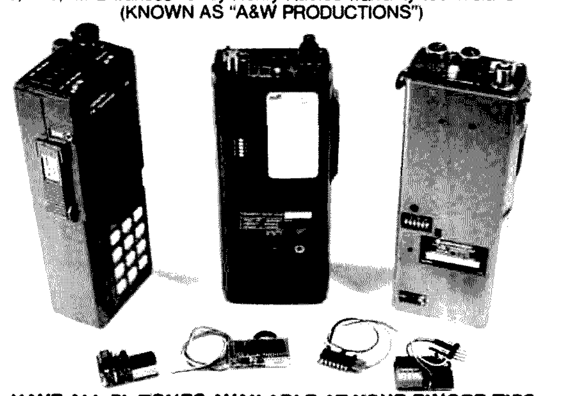

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crystal switched in, it was found that locking of the vco extended only to 152 MHz. The range can be extended to 155 MHz by tuning T6, but the lower portion of the 2-meter band would not lock. This is an uncompromising situation, especially with the new repeater subband and fire and law enforcement between 153 and 155 MHz.

Is it possible to have the best of both worlds? Yes. This is the reason for the 4-position DIP switch rather than a two-position one. In order to extend the lock range of the vco, a varactor diode was incorporated.

Some general rules must be clarified before proceeding to any physical modifications. First, removing any components is out of the question. This is because the S-1 uses flow-through solder. The risk of damaging other components is high. Second, the varactor diode must be connected to a point where the dc voltage is isolated since the diode must be controlled by a dc voltage. The schematic for the vco is shown in Fig. 4. The node between C30 and C31 is the only point at which a varactor diode could be placed.

The 1N5148 varactor diode was chosen because of its range, 47 pF (no voltage) and 14.7 pF (minimum value), with about 10-volts reversed bias across it. A 220k (1/8-Watt) resistor was tied to Vcc to reverse-bias the diode. An additional resistor must be used to discharge the diode when the voltage is removed. Bypass capacitor C1' was placed next to R1' to prevent rf interference, and C2' was installed next to R2'. The final configuration appears as shown in Fig. 5.

In the 150-155-MHz area, the switch is closed, which reduces the capacitance on the varactor diode. In the 140-150-MHz region, the switch is opened. The two additional resistors should be 1/8-Watt to conserve space, but there is room for 1/4-Watt resistors. C1', D1', and R1' are placed at the bottom printed circuit board under the shield plate in parallel with C30, as shown in Fig. 6. This method is preferable to minimize lead inductance. R2' and C2' were mounted next to S3 since its lead inductance is not important. It is recommended that a frequency counter and rf generator be available so that T6 can be optimized for maximum bandwidth.

The uncommitted switch on the 4-position DIP switch can be used for subaudible tone or tone burst if desired. Mounting of the DIP switch is done on back of the transmit board, as shown in Fig. 7. A square hole is made on the back of the S-1 to access the switch, as shown in Fig. 8. Be sure to define the position of the hole carefully so that the position of the hole will match the position of the switch.

Useful Hints

Because the S-1 is so compact, rf tends to feed back into the critical sections of the transceiver. It was found that bypass capacitors (0.1 uF) installed in the supply leads in both the receiver and transmitter boards improved the PLL stability. As a general rule, do not solder the crystal case to ground. This can break the vacuum seal on most crystals and shift its frequency, and at times it may stop oscillating altogether. However, clamping the crystal to ground is permissible and is recommended. Also, placing a sheet of aluminum foil around the battery and then grounding it eliminates rf feedback into the touchtone™ pad.

Results

The original specifications of the S-1 are unchanged. In the low extreme (140 MHz) sensitivity is still below 1 uV, while at 155 MHz it was observed to be 1.5 uV, more than adequate for most applications. The vco lost lock at 156 MHz but was extremely stable below 155 MHz. By tuning T6, the upper or lower frequency extremes can be extended but the overall bandwidth is about 15 MHz. On transmit, at least 1.5 Watts was available at all frequencies. (Remember: A dummy load must be used when testing on unauthorized frequencies.) While switching from 140-150 MHz to 150-155 MHz, the unit must be turned off while the crystal is switched and then turned on again. This is because once the vco locks to a certain frequency, it is difficult to break lock and relock again when there is a 3-MHz difference between the two oscillator crystals.

The author would like to thank Glen Toth of Signetics for the photographs. ■

Items Needed

1—Crystal (same as for the AR-22C—X-3, 46.433 MHz)
1—4-position DIP switch
6"—RG-178 B/U coax or equivalent (RG-174 can be used but it is bulky)
1—Varactor diode, 1N5148
2—1/8-Watt, 220k resistors
2—0.1-uF bypass capacitors

The Tempo S-1 service manual can be obtained from Henry Radio, 2050 S. Bundy Drive, Los Angeles CA 90025, for $7.50

The crystal may be obtained from Ace Communcations, Inc., 2832-D Walnut Avenue, Tustin CA 92680, for $2.00

Mike Richardson N5MR
5467 Plantain Circle
Orangevale CA 95622

CW and the Apple II

The simplicity of BASIC plus the speed of machine language equals a near-perfect Morse keyboard.

There are many good programs floating around for the Apple II microcomputer which will let one touch-type Morse code. However, CW isn't nearly as effective coming out of the Apple's itty-bitty speaker as it is coming out of your antenna. This article describes a very simple (and cheap!) interface for the Apple which should key most rigs.

The key to this interface is the neat little game I/O connector that Apple has so thoughtfully included with your computer. This connector is an ordinary 16-pin DIP socket with the layout shown in Fig. 1.[1]

Although there are 16 pins on this connector, only three of them are needed for this interface. These are: pin 1 for +5 volts, pin 8 for ground, and pin 15 as the keying output.

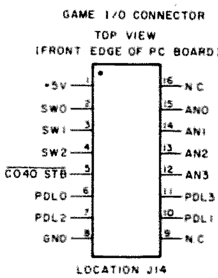

Fig. 1.

I next took an ordinary 16-pin solder-tail DIP IC socket (16¢ at James Electronics) and soldered wires to pins 1, 8, and 15 on it. I use this socket as a male plug, and plug it into the game paddle I/O socket whenever I get in the mood for CW.

Pin 15 is designated output AN0 by Apple, and is driven by chip F14, a 74LS259. The Apple manual suggests buffering this output, and Fig. 2 shows the buffering circuit I used to key my Ten-Tec Triton IV transceiver.

U1 is a single AND gate from a 74C08 CMOS quad AND gate (49¢ at Radio Shack). Q1 is a 2N2222 NPN utility transistor (10¢ at Radio Shack).

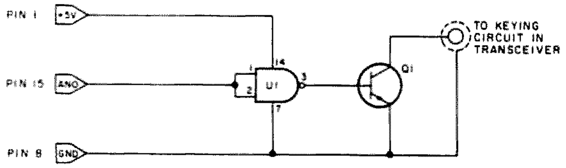

Fig. 2.

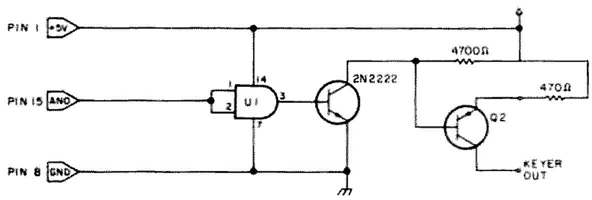

Fig. 3.

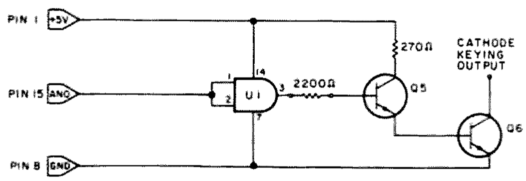

Fig. 4.

There are other combinations of parts that work which may even be cheaper than this circuit. However, these are the first ones I ran across in my junk box, and, as the old proverb says, "If it works, don't fix it."

One word of caution: If you use a quad CMOS chip, as I did, be sure to ground the inputs to the unused gates—otherwise the chip may malfunction. Thus, for the 74C08, you should ground pins 4, 5, 9, 10, 12, and 13.

My Triton IV is an all-solid-state rig employing low keying voltages that a 2N2222 can handle with ease. If your rig uses grid-block keying, a slightly different circuit should be used—see Fig. 3.

Q2 can be substituted, but should have a V_{ce} greater than the keying voltage employed in your rig. The 2N5401 and the 2N4888 can handle up to about 300 volts.

For a cathode-keyed rig, the circuit in Fig. 4 can be used.

Q5 is a 2N4123, and Q6 is a high-voltage, high-current silicon NPN power transistor such as the Delco DTS-801, -802, or -804.

The connoisseur of keying circuits may find the latter two of these circuits very familiar. They are borrowed from Jim Garrett's (WB4VVF) excellent article on the Accukeyer.[2]

Well, so much for the hardware end—the rest is free! (I spent 75¢ for parts for my interface. Add an extra buck or two if your rig requires one of the latter two circuits.) The only thing remaining is to add statements to your CW program which will tell it to turn the AN0 output on and off at the right times.

By POKEing a 0 into location −16296 (hex $C058), AN0 is set to zero volts. Conversely, by POKEing a 0 into memory location −16295 (hex $C059). AN0 is switched to +5 volts.

CW programs can vary greatly, but probably all of them, whether written in BASIC, assembly language, or machine language, will have one subroutine to send a dit and another subroutine to send a dah. If your program is in BASIC, then the statement POKE −16296, 0 should be added to your program as the first statement in both the dit-forming and dah-forming subroutines. Likewise, add the statement POKE −16295, 0 as the last statement in each subroutine. Also, it is a good idea to add the statement POKE −16296, 0 as one of the first statements in your program, so that output AN0 will be initialized to zero volts each time the program is run.

If your dit- and dah-forming subroutines are in assembly or machine language, the following commands will work. Insert the command:

```
AD 59 C0        LDA $C059
```

immediately before the command which starts the code element sounding. Likewise, insert:

```
AD 58 C0        LDA $C058
```

immediately after the command, which stops sounding the code element.

As a final example, here are a few details from my own CW program, which is based on "The Morse Master," *73 Magazine*, January, 1979, p. 114. A BASIC listing of the pertinent parts of my program is shown in Fig. 5.

The Morse code is held in an array A$(P), where 3s stand for dahs and 1s stand for dits. As each letter is typed on the Apple keyboard, the corresponding value in the array is returned. For example, when C is pressed, the value 3131 is returned from the array. The subroutine at 1000 then peels off the digits one by one from the left. If a 3 is present, the dah subroutine at 1300 is selected. If a 1 is present, the dit subroutine at 1200 is selected.

My dit and dah subroutines are almost identical. They each call the same machine-language subroutine at memory location 16002. This subroutine is listed in machine and assembly form in Fig. 6. In hex, 16002 is written as $3E82.

This machine-language program is almost identical to the tone-generator program shown on pages 43-45 of the Apple Reference Manual. Each time before it is called, two values must be POKEd into memory. The first is variable PP, which determines the frequency of the output tone through the speaker. This can be any number between 0 and 255 (I prefer 96) and this number is POKEd into memory location 16000 (hex $3E80). The second number required by the subroutine tells it how long the code element should be sent. In the dit subroutine, this is variable X, and, in the dah subroutine, I used variable T. This second number is POKEd into memory location 16001 ($3E81 hex). (I use X = 10 and T = 40 for a code speed of about 30 wpm.)

```
   6  GOSUB 32000
   7  POKE -16296,0
  10  HIMEM: 15999
 199  REM—MORSETYPER MAIN PROGRAM
 200  GET K$
 220  P = ASC(K$)
 225  REM—PRINTS LETTER TO BE SENT ON SCREEN
 230  PRINT CHR$(P);
 240  GOSUB 1000
 250  REM—ADDS SPACE AFTER EACH LETTER
 260  FOR Q = 1 TO SP ; NEXT Q
 300  GO TO 200

 999  REM—MORSE SENDING SUBROUTINE
1000  L = LEN( A$(P) )
1005  FOR I = 1 TO L
1010  R$ = MID$( A$(P) , I , 1)
1015  IF R$ = "1" THEN GOSUB 1200
1020  IF R$ = "3" THEN GOSUB 1300
1025  NEXT I
1030  RETURN
1199  REM—DIT SUBROUTINE
1200  POKE 16000, PP: POKE 16001,X : CALL 16002
1201  FOR L = 1 TO X : NEXT L
1202  RETURN
1299  REM—DAH SUBROUTINE
1300  POKE 16000,PP : POKE 16001, T : CALL 16002
1301  FOR L = 1 TO X : NEXT L
1302  RETURN
```

Fig. 5. BASIC listing.

Notice that the first statement in the assembly-language program is LDA $C059, which sets the game I/O output AN0 to 5 volts. When the code element has all been sent, the program branches to $3E99 where the command LDA $C058 is given, which resets AN0 to zero volts before returning to the main BASIC program.

```
3E82   AD 59 C0   LDA $C059
3E85   AD 30 C0   LDA $C030
3E88   88         DEY
3E89   D0 05      BNE $3E90
3E8B   CE 81 3E   DEC $3E81
3E8E   F0 09      BEQ $3E99
3E90   CA         DEX
3E91   D0 F5      BNE $3E88
3E93   AE 80 3E   LDX $3E80
3E96   4C 85 3E   JMP $3E85
3E99   AD 58 C0   LDA $C058
3E9C   60         RTS
```

Fig. 6.

Fig. 7 shows a BASIC listing which will POKE the machine-language subroutine in Fig. 6 into memory at location 16002 (hex $3E82). One of the first statements in my main BASIC program calls this subroutine before any other action is taken by the program.

Well, that's it in a nutshell. If anyone has any problems, send me an SASE and I'll try to help. ■

References

1. ***Apple II Reference Manual***, January, 1978, p. 25.
2. ***The Radio Amateur's Handbook***, ARRL, 1977, p. 364-5.

```
32000 POKE 16002,173: POKE 16003,89  : POKE 16004,192
32005 POKE 16005,173: POKE 16006,48  : POKE 16007,192
32010 POKE 16008,136: POKE 16009,208: POKE 16010,5
32015 POKE 16011,206: POKE 16012,129: POKE 16013,62
32020 POKE 16014,240: POKE 16015,9   : POKE 16016,202
32025 POKE 16017,208: POKE 16018,245: POKE 16019,174
32030 POKE 16020,128: POKE 16021,62  : POKE 16022,76
32035 POKE 16023,133: POKE 16024,62  : POKE 16025,173
32040 POKE 16026,88  : POKE 16027,192: POKE 16028,96
32050 RETURN
```

Fig. 7. BASIC subroutine for POKEing machine-language subroutine into memory at location 16002 (hex $3E82).

Allan S. Joffe W3KBM
1005 Twining Road
Dresher PA 19025

Everyman's Audio Amplifier

Make this one-chip amp a permanent part of your test bench. It's an easy project for beginning experimenters.

Motivation seems to be a combination of need, circumstance, and availability. These all came together when my audio signal tracer died its final time, died when I needed to check a mike that someone said "doesn't sound like it used to."

I have long ago learned *not* to ignore good advice in small packages that come over the local repeater. The availability was provided by an IC, a Toshiba TA7205P that had been purchased from Digital Research, a good source of supply that I first met through *73*. The charm it held for me is that its pins will fit into one side of a standard 20-pin DIP socket.

The diagram of the finished product is shown in Fig. 1. The external parts count is low and non-exotic. The supply voltage range is wide enough to make it go from any small supply that you have around the bench, and it works "carside" quite well, running off a cable that goes into the cigarette lighter. The series RC network connected to pin 7 is the gain set.

As shown, there is ample gain to get a fair amount of noise out of the average mike. The volume control allows the handling of a good range of input levels, making it handy for many bench chores.■

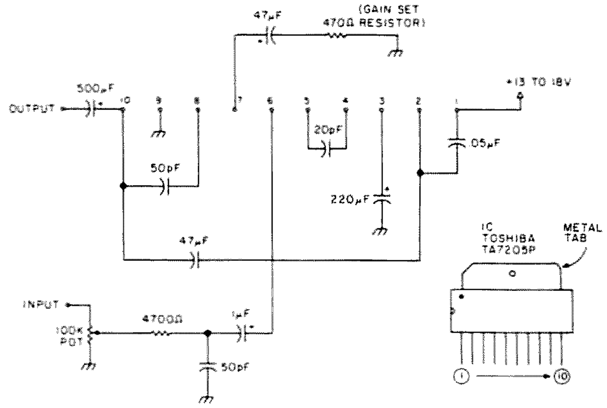

Fig. 1. Schematic of the general-purpose, one-IC audio amplifier.

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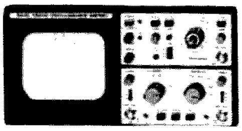

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Certificate hunters, cut your paperwork down to size. Let your Pet track your quest for excellence.

Here's a simple program for the Pet that was designed to keep track of what states have been worked on what bands for 5BWAS. For each state, the program records the callsign of the station worked on each band (80, 40, 20, 15, and 10 meters). You can display the entries, just the totals for one particular band, or the totals for all bands combined (mixed). The data is stored in a data file on cassette tape and takes about two minutes to load, save, or verify. The program also provides a way of changing or deleting any entry, if required.

The program was written to be flexible enough that it could be used for other awards records such as Worked All Zones (WAZ) or Worked All Continents (WAC). To change the program for another award, simply modify the values in lines 180-200 as required:

AW$ = The 3-letter award name (WAS, WAZ, WAC, etc.)

NE = The number of entries for the award—must be 50 or less due to the current Pet display limitations. (WAS = 50, WAZ = 40, WAC = 6, etc.)

IE$ = Entry input question used in line 770:
For WAZ you could use:
IE$ = "ZONE (01-40)".
For WAC you could use:
IE$ = "CONTINENT (NA, SA, EU, AF, AS, OC)"

K$ = The string of entry names each 2 characters long:
For WAZ you would use:
190 K$ = "010203......20",
200 K$ = K$ + "212223......40".
For WAC you would use:
190 K$ = "NASAEUAFASOC"
200 (deleted—not used!)

Program listing.

```
100 REM ******  5BWAS-RECORDS  *******
110 REM
120 REM BY - ROBERT W. BAKER, WB2GFE
130 REM          15 WINDSOR DRIVE
140 REM        ATCO, NEW JERSEY 08004
150 REM
160 REM ********************************
170
180 AW$="WAS"   NE=50   IE$="STATE (2-LETTER ABBREV)"
190 K$="ALAKAZARCACOCTDEFLGAHIIDILINIAKSKYLAMEMDMAMIMNMSMOMTNENV"
200 K$=K$+"NHNJNMNYNCNDOHOKORPARISCSDTNTXUTVTVAWAWVWIWY"
210
220 POKE 59468,12   DIM D$(NE),T(6)   NH=INT(NE/2) : E$=".........."
230
240 REM DISPLAY MENU
250
260 PRINT"";SPC(10);"";AW$;" - AWARD RECORDS"
270 GOSUB 1410   CLOSE 1   PRINT"   0 = DONE"
280 PRINT"   1 = LOAD DATA FROM TAPE"
290 PRINT"   2 = SAVE DATA ON TAPE"
300 PRINT"   3 = VERIFY DATA ON TAPE"
310 PRINT"   4 = INITIALIZE DATA"
320 PRINT"   5 = ENTER DATA (ADD,CHANGE,DELETE)"
330 PRINT"   6 = DISPLAY DATA"
340 PRINT"   7 = DISPLAY TOTALS"   GOSUB 1410
350 PRINT"ENTER COMMAND  ";
360 GET R$ IF R$="" THEN 360
370 IF R$="0" THEN PRINT R$   END
380 N=VAL(R$)   IF N<1 OR N>7 THEN 360
390 PRINT R$
400 IF IL<>0 THEN ON N GOTO 460,540,610,700,760,990,1260
410 ON N GOTO 460,420,420,700
420 PRINT"INITIALIZE OR LOAD DATA FIRST!" : GOTO 350
430
440 REM LOAD DATA FROM TAPE
450
460 PRINT"INSERT ";AW$;" INPUT TAPE"
470 OPEN 1,1,0,AW$+".DATA" : PRINT"READING DATA!"
480 FOR N=1 TO NE   INPUT#1,D$(N) : IF ST=0 THEN NEXT
490 IF ST=64 AND N=NE THEN PRINT"*** DATA LOADED ***"   IL=1   GOTO 270
500 GOTO 660
510
520 REM SAVE DATA ONTO TAPE
530
540 PRINT"INSERT ";AW$;" OUTPUT TAPE"
550 OPEN 1,1,1,AW$+".DATA"   PRINT"WRITING DATA!"
560 FOR N=1 TO NE   PRINT#1,D$(N) : NEXT
570 PRINT"*** DATA SAVED ***"   GOTO 270
580
590 REM VERIFY DATA ON TAPE WITH MEM
600
610 PRINT"INSERT ";AW$; " TAPE TO VERIFY"
620 OPEN 1,1,0,AW$+".DATA" : PRINT"VERIFYING DATA!"
630 FOR N=1 TO NE : INPUT#1,C$ : IF ST=0 AND C$=D$(N) THEN NEXT
640 IF ST=64 AND N=NE THEN PRINT"*** TAPE DATA VERIFIED ***" : GOTO 270
650 IF C$<>D$(N) THEN PRINT"DATA MIS-MATCH!"   GOTO 270
660 PRINT"TAPE READ ERROR!   ST = ";ST   GOTO 270
670
680 REM INITIALIZE ALL ENTRIES
690
700 PRINT"CLEARING ALL ENTRIES!"
710 FOR N=1 TO NE   D$(N)=E$+E$+E$+E$+E$   NEXT
720 PRINT"*** DATA INITIALIZED ***" : IL=1 : GOTO 270
730
740 REM ADD, CHANGE, DELETE ENTRIES
750
760 PRINT""
770 PRINT"";IE$;"   ";   INPUT R$   IF R$="" THEN 260
780 N=0 : FOR Z=1 TO (2*NE)-1 STEP 2   N=N+1
790 IF R$<>MID$(K$,Z,2) THEN NEXT   GOTO 770
800 INPUT"BAND (80,40,20,15,10)   ";R$   IF R$="" THEN 770
810 I=-1 IF R$="80" THEN I=0
820 IF R$="40" THEN I=10
830 IF R$="20" THEN I=20
840 IF R$="15" THEN I=30
850 IF R$="10" THEN I=40
860 IF I<0 THEN 800
870 PRINT"CURRENT ENTRY = ";MID$(D$(N),I+1,10)
880 INPUT"CALL (D=DELETE)   ";C$ : IF C$="" THEN 770
890 IF LEN(C$)>10 THEN 880
900 IF C$="D" THEN C$=E$
910 C$=LEFT$(C$+E$,10) : B$=C$+RIGHT$(D$(N),40)
920 IF I<1 THEN 950
930 B$=LEFT$(D$(N),I)+C$
940 IF I<40 THEN B$=B$+RIGHT$(D$(N),40-I)
950 D$(N)=B$ : GOTO 770
960 :
970 REM DISPLAY DATA BY BAND/MIXED
980
990 INPUT"BAND(80,40,20,15,10,M=MIXED)   M";B$
1000 I=0 : IF B$="80" THEN I=1
1010 IF B$="40" THEN I=11
1020 IF B$="20" THEN I=21
1030 IF B$="15" THEN I=31
1040 IF B$="10" THEN I=41
1050 IF (I=0) AND (B$<>"M") THEN 990
1060 PRINT" ";AW$;" "   PRINT"RECORDS"   PRINT""
1070 PRINT"BAND:"
1080 IF I=0 THEN PRINT"MIXED"
1090 IF I>0 THEN PRINT B$;" MTRS"
1100 PRINT"";
1110 FOR N=1 TO 25 : IF N>NH THEN PRINT TAB(9);"I"; : GOTO 1150
1120 IF I=0 THEN 1190
1130 PRINT TAB(9);"I  ";MID$(K$,2*N-1,2);" ";MID$(D$(N),I,10);
1140 PRINT" ";MID$(K$,(2*N)+NE-1,2);" ";MID$(D$(N+NH),I,10);
1150 IF N<>25 THEN PRINT
1160 NEXT N
1170 PRINT"DEPRESS"
1180 PRINT"ANY KEY" : PRINT" TO" : PRINT"CONTINUE" : GOTO 1390
1190 FOR X=1 TO 41 STEP 10 : C$=MID$(D$(N),X,10) : IF C$=E$ THEN NEXT
1200 PRINT TAB(9);"I  ";MID$(K$,2*N-1,2);" ";C$;
1210 FOR X=1 TO 41 STEP 10 : C$=MID$(D$(N+NH),X,10)   IF C$=E$ THEN NEXT
1220 PRINT" ";MID$(K$,(2*N)+NE-1,2);" ";C$;   GOTO 1150
1230 :
1240 REM ADD BAND TOTALS
1250 :
1260 PRINT"ADDING BAND TOTALS!"
1270 FOR X=1 TO 6 : T(X)=0   NEXT X
1280 FOR N=1 TO NE   T(0)=0   FOR I=1 TO 5
1290 IF MID$(D$(N),10*I-9,10)<>E$ THEN T(0)=1   T(I)=T(I)+1
1300 NEXT I   T(6)=T(6)+T(0)   NEXT N
1310 PRINT"   ";AW$;" TOTALS   "
1320 PRINT SPC(11);"80 METERS  ";T(1)
1330 PRINT SPC(11);"40 METERS  ";T(2)
1340 PRINT SPC(11);"20 METERS  ";T(3)
1350 PRINT SPC(11);"15 METERS  ";T(4)
1360 PRINT SPC(11);"10 METERS  ";T(5)
1370 PRINT SPC(9);"MIXED BANDS  ";T(6)   PRINT   GOSUB 1410
1380 PRINT"   DEPRESS ANY KEY TO CONTINUE!"
1390 GET R$   IF R$="" THEN 1390
1400 GOTO 260
1410 PRINT"────────────────────────────────────────"   RETURN
```


Reader Service for facing page ↙5→

Once these three lines have been changed, the rest of the program should not have to be modified.

The remainder of the program is very straightforward. Line 220 ensures that the Pet is in the upper-case/graphics mode and defines the data (D$) and totals (T) arrays along with the blank entry value (E$). Lines 260-340 display the program "menu" which allows the user to select the desired program function from those available. Lines 350-380 get the number of the desired function and check that a valid selection was made. Lines 400-420 then branch to the routine to perform the selected function, but the data must first be initialized or loaded from tape before any other function can be performed. This ensures that the data matrix (D$) has been set correctly before attempting to use any values contained within it. Each of the available functions is then performed by one of the routines in the remainder of the program.

The first time you use the program, initialize the data to clear all entries. Then enter each callsign for the appropriate QSO on each band for each state. You make the entries by first specifying the state to be entered. If you hit "RETURN" without making an entry, the program will return to the menu selection. If the state is not found (incorrect 2-letter code), you will be asked again for the band (80, 40, 20, 15, or 10 meters). If "RETURN" is entered without any data, you will be asked for the state again. If an incorrect band is entered, you will be asked for the band again.

When a correct state and band have been entered, the current entry for that state and band will be displayed. If you enter "RETURN" without any data, the current entry will be unchanged and you will be asked for the next state. If you enter a "D" followed by "RETURN", the current entry will be deleted (set back to periods). Any other data entered followed by "RETURN" is assumed to be the callsign to be entered for that state on that band. If the callsign is longer than 10 characters, you will have to reenter the callsign. All callsigns entered will have periods appended to make them 10 characters long before they are stored. The five callsigns for each state are stored together as one 50-character string to save memory space.

When all entries have been made, display the data on each band and check it correct. If required, go back and make any corrections. You also can display the totals and check for the correct number of states on each band. Before stopping the program, make sure that you save the data on tape. It's also a good idea to take the extra time to verify the data file, to make sure it was correctly saved. You might even want to save more than one copy on tape while you have everything in memory. Now you simply load the old data file the next time you want to add, correct, or examine anything. If you make any changes, don't forget to save the new data on tape. For those who want to go even further with their award records, you could keep separate data files for each mode (SSB, CW, RTTY, SSTV, etc.).

To answer the question before it's asked, for anyone too lazy to type in the program, I'll be happy to supply copies on tape for $2.00 each. However, *please send all requests directly to me* and not through the magazine. ■

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Speed Demon

How fast was that? Find out with this wpm display for Heath's 1410 keyer.

Jerry Wayne Campbell K4ZHM
Rte. 4, Box 126 Barkley
Nicholasville KY 40356

In the following, I will describe a digital display I added to my Heath 1410 keyer to display the wpm setting of the keyer. The same principle can be applied to other keyers.

First, let's look at what we need to calculate the words-per-minute speed of the keyer. The *ARRL Handbook* gives the following formula for calculating code speed:

words/min = dots/min/25 = 2.4 × dots/sec

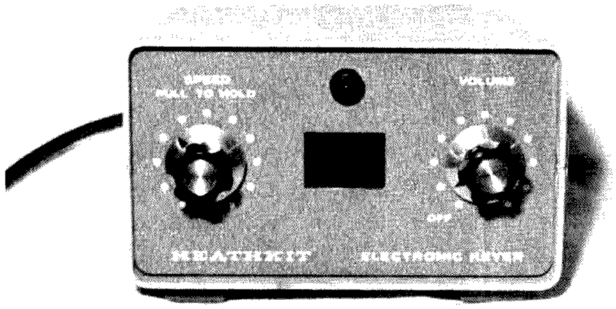
From the Heath 1410 keyer manual, we see that for each dot generated (space included), the clock in the keyer generates two pulses. The clock pulse rate is twice the dot rate. If we measure the clock pulses instead of the dots, the formula becomes:

words/min = 1.2 clock pulses/sec

Multiplying the clock pulses/sec by 1.2 is the same as measuring the clock pulses for 1.2 seconds. 1.2 seconds is 72 cycles at the 60-Hz power-line frequency; therefore, if we count the clock pulses for 72 cycles of the line frequency, we are effectively multiplying our keyer clock pulses/sec by 1.2. Thus, by counting the clock pulses from the keyer for 1.2 seconds, we can read the code speed directly on the seven-segment displays.

Referring to the timing diagram in Fig. 1, we see that by dividing the 60-Hz line frequency as shown (first by 6, then again by 6, then by 2, then finally by 2; see Fig. 2) we obtain a 1.2-second gating pulse. We now have the means to time the keyer clock pulses for 1.2 seconds and the count will update each 1.2 seconds. The reset pulse clears the counters 0.6 seconds prior to the counting interval. Send dots and/or dashes for over 2.4 seconds, and the readout will display for 0.6 seconds the speed at which the keyer is set.

Power, the 60-Hz line frequency, and, of course, the keyer clock pulses are all taken from the keyer. Refer to Fig. 3 and the Heath 1410 keyer manual for the fol-



The assembled keyer with the counter modification.

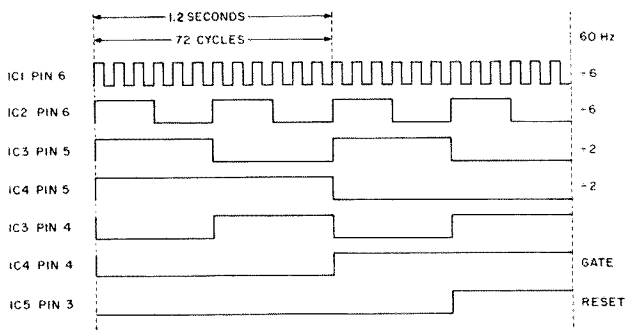
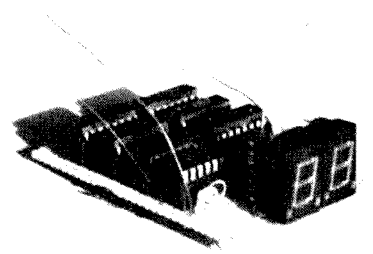
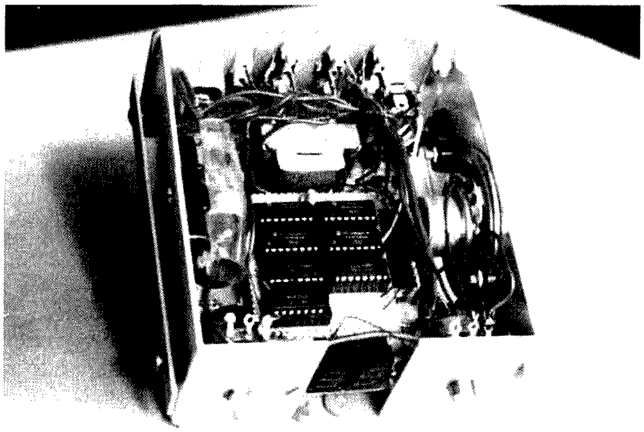


Fig. 1. Timing pulses appearing at various points in the circuit.



The completed counter board before mounting in the keyer.



The counter board is mounted using right-angle brackets and the mounting holes for the removed paddles.

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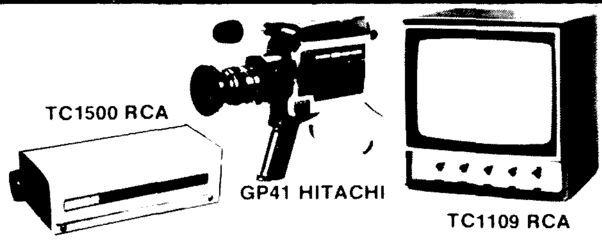

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lowing connections. The keyer clock pulse is obtained from point D on the keyer speed control. The 60-Hz signal is obtained from either side of the secondary of the power transformer and ground. The resistor values shown, R1 and R2, are for the Heath keyer. A convenient source for the 5 V dc is the speaker lead that is connected to the 5 V dc supply.

I replaced the neon on-off indicator lamp with an LED. I then connected the inputs of the remaining 1/4 IC5 to pin 12 of IC3 in the keyer, and the output to the LED; see Fig. 2. The LED lights up on the mark portion of the code character.

When sending code, the display of the speed will vary. You are seeing the average speed at which you were sending in that 1.2-second interval.

There are several methods of housing the display. I use a Bencher paddle with my keyer, so I removed the keyer paddles from the keyer and took out the center post. I then mounted a red lens over the opening. The display and circuitry are then mounted behind the lens using the mountings for the removed paddle assembly. ■

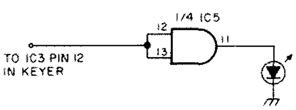

Fig. 2. LED mark indicator for keyer output.

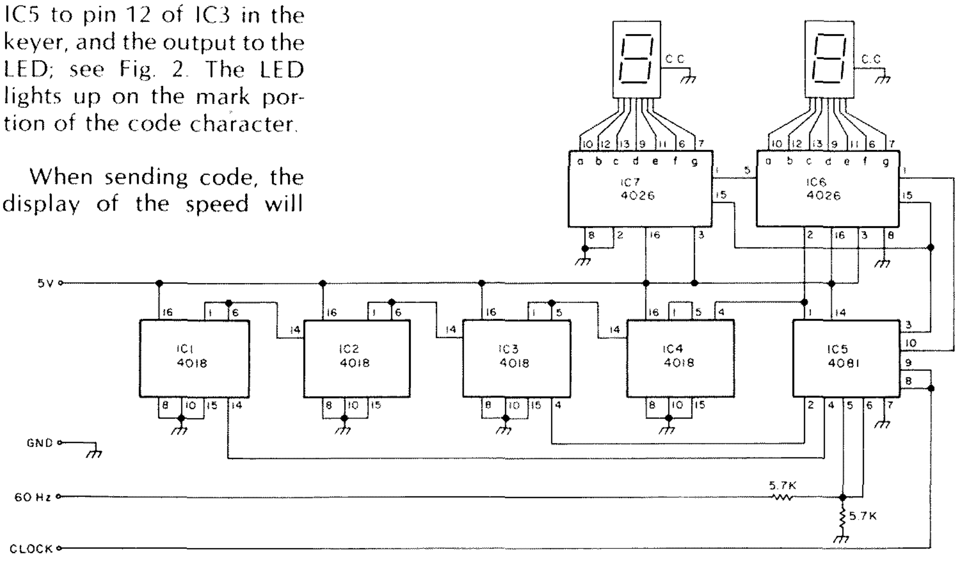

Fig. 3. Code-speed reader for the Heath 1410 keyer.

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Keyer on a Shoestring

Hams are cheap and so is this keyer. Big spenders will build the deluxe, two-chip version.

Joel R. Donaldson WB5PPV
17 Fenwick Drive
Laredo TX 78041

Most great keyers aren't very cheap, and most cheap keyers aren't particularly great. However, here's a fair-to-good one you can build for around $10.00 using all new parts. If you've got any sort of junk box at all, it should cost you quite a bit less. It's not iambic or self-completing, it lacks contest memories, weight control, and a few other bells and whistles, but it is simple, draws very little current, fits nicely into a small package, and is capable of sending good, clean CW. A keying transistor and floating ground make it usable with just about every modern rig, and a sidetone circuit can be added easily if your rig lacks one. In short, it makes a good first keyer or a nice second circuit for the vacation or QRP set.

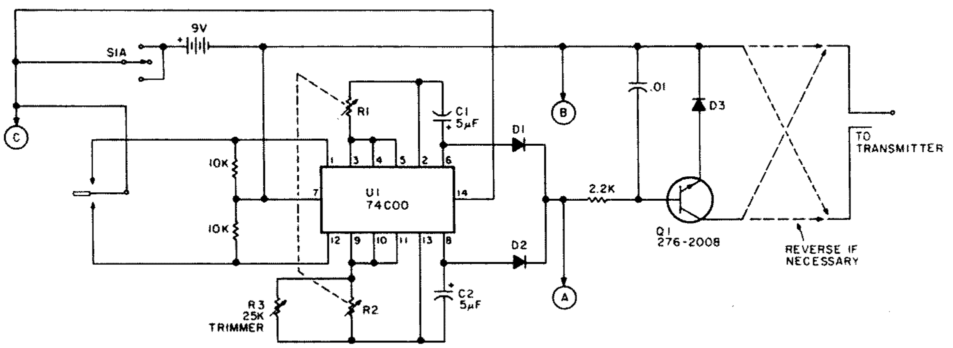


Fig. 1. One-chip keyer circuit. The entire circuit must be isolated from the enclosure. R1, R2—30k or 50k "stereo" linear taper dual pot. D1, D2, D3—any silicon diode. Q1 shown is a Radio Shack part number.

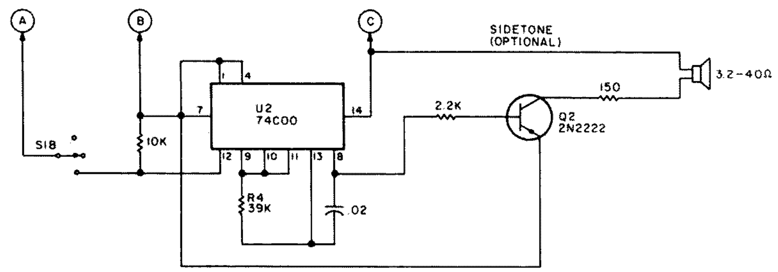


Fig. 2. Optional sidetone circuit connects to the keyer at points A, B, and C.

As shown in Fig. 1, the whole keyer is built around a 74C00 quad NAND gate which is connected to form two independent oscillators. The frequency of each oscillator is dependent upon a capacitor (C1 for one, C2 for the other) and a resistor (R1 for one, R2 for the other). By simultaneously varying R1 and R2, both oscillators can be sped up or slowed down, and a third resistor (R3) makes one of the oscillators run a

fixed percentage faster than the other, thereby providing a definite dash-to-dot ratio. The output of both oscillators is connected to the sidetone (if used) and to Q1, the keying transistor, through D1 and D2, which prevent one oscillator from interfering with the other. Q1 conducts whenever either oscillator is in the "on" state, thus keying the transmitter in step with the oscillators.

The sidetone circuit (Fig. 2) also consists of a 74C00 connected as an oscillator, but with R and C values changed so as to produce an audio-frequency tone. The output of this oscillator is switched by Q2, which provides enough drive to power a small speaker. The pitch of the sidetone may be changed by using a slightly different value for R4. The sidetone circuit connects to the keyer at points A, B, and C.

I mentioned earlier that this circuit has a floating ground. As shown on the schematic, no connections are to be made to the keyer cabinet. This eliminates expensive and hard-to-find reed relays, lowers power consumption, and sidesteps the need to modify the keyer whenever a different transmitter is used. Also, it is suggested that you stick to a battery to power your keyer unless you are certain that your power supply is isolated from ground. When connecting the keyer for the first time, it may be necessary to reverse the two keyer output leads to prevent the transmitter from being keyed all the time (wrong polarity to Q1). After the correct way has been found, a connector can be soldered on.

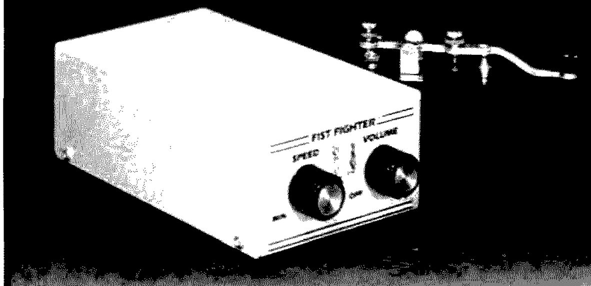
Adjustment consists of merely trimming R3 until the dits are about one-third as long as the dahs. Once this has been done, it will probably never have to be done again, since this ratio stays about the same over a fairly wide range of keying speeds and battery voltages. However, if it is anticipated that several operators of widely varying proficiencies will be using the same keyer, it might be better to make R3 a front-mounted control or at least provide a hole in the cabinet for quick screwdriver adjustments.

It seems kind of pointless to blow a considerable amount of money on a keyer paddle when the actual circuitry costs so little, so I would like to suggest a rather unoriginal but appropriately frugal alternative. It consists of a short piece of steel packing strap or hacksaw blade sandwiched between two telephone switch or relay contacts. The packing strap or blade is scraped clean of all paint in the contact area, and a piece of paddle-shaped Plexiglas™ which protrudes through the front of the cabinet is bolted to one end. When the paddle is moved in either direction, the strap touches one of the contacts. The strap need not make a perfect connection for the keyer to operate, since the CMOS oscillators will operate even with several thousand Ohms of contact crud. The strips of phenolic that insulated the switch or relay before modification are used in the same application; they make sure that neither the strap nor the contacts make an electrical connection with the cabinet. Fig. 3 shows one possible arrangement for the entire keyer, including the paddle.

Rf shielding for this circuit is not too critical; the prototype worked fine with no case at the 100-Watt level. I used a 1- by 1½-inch piece of perfboard for the keyer circuit, and the sidetone was added as an afterthought on another small piece of board. A center-off switch was used to control both the keyer power and sidetone, as the HW-101 already has a sidetone built in.

With the cost of amateur radio equipment what it is today, CW just has to offer one of the best potentials for having a lot of fun without spending a lot of money. Vintage CW rigs abound on the used market, and a good QRP rig can be purchased new without going too far into debt. Costing about as much as a cheap microphone, this circuit reflects the same spirit of fun on a shoestring. Use and enjoy. ■

NOT-A-KEYER



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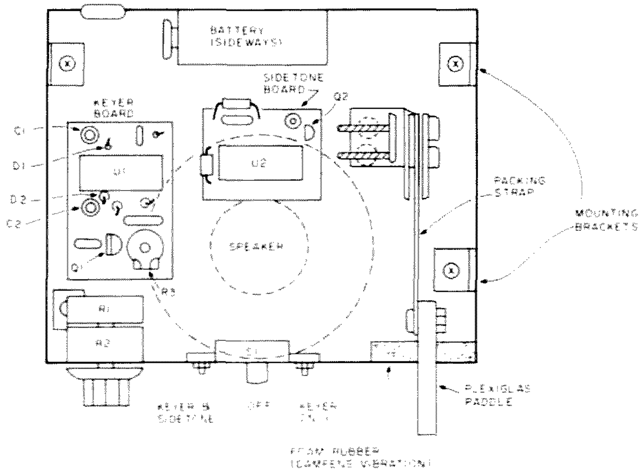


Fig. 3. Typical arrangement of circuit boards, controls, and paddle.

✓See List of Advertisers on page 130

Paul M. Danzer N1II
2 Dawn Road
Norwalk CT 06851

I Got My Ticket! Now What?

A look at what Elmer forgot to tell you.

For many recently licensed hams, trying to operate a new ham station is just as difficult as learning the code or studying for the written exams. Anyone who has ever been involved in a licensing class knows people who have gotten licenses and set up stations, but never quite made any contacts on the air. New hams have many questions about operating. The following are some of the more common ones.

Local Time	80	40	Band 20*	15	10
6:00 am					
9:00 am			DX		
Noon			DX	DX	
3:00 pm	Local		DX	DX	DX or Local
6:00 pm	Local/ Ragchew	Local/ Ragchew	DX	DX	DX or Local
9:00 pm	Crowded	Crowded	DX/ Crowded	DX	Local/ Ragchew
Midnight	Ragchew	Crowded	DX/ Crowded		

***If allowed by license class**

Fig. 1. "Best bet" operating frequencies for a newcomer (1981-82).

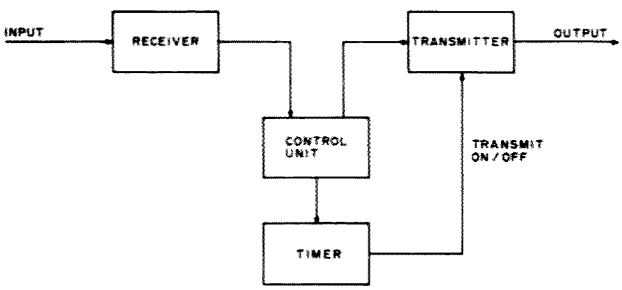


Fig. 2. Typical repeater.

I have had my station set up for a month and have managed to make just one contact. How come?

Let's assume your rig is working. The problem could be where and when you are trying to operate. For example, on a Friday or Saturday night, 80 and 40 meters (Novice band) are jammed and just about everyone has a problem. If you try 10 meters and the band is closed, you still won't work anybody. The trick is to pick a band and a time when there are a number of stations on, but the QRM is not overwhelming. Try 40 meters in the late afternoon, 15 in the early evening, or 10 on a Sunday afternoon (see Fig. 1).

Should I call CQ or just listen?

Use common sense. If you tune around for a few minutes and don't hear anyone calling, you can try a CQ, but pick a quiet frequency and limit your CQ.

Why limit it? I thought the traditional 3×3 or even a 3×4 was a good idea.

Look at it from the listener's point of view. If I hear you calling CQ for a long period of time and get tired of listening to you call, I won't want to reply to you. If you are that boring with a CQ, think how boring you would be in a QSO. With today's equipment, just call "CQ CQ CQ de WA1WTB WA1WTB," repeat once, and then K. If there is no answer, you can always try again.

You said to pick a quiet frequency. How can I tell if no one is using it?

Assuming you don't hear anything, just send QRL or IE. On voice, say "Is this frequency in use?" If there is no reply, you are perfectly correct to assume you can transmit without bothering anyone.

Am I better off operating CW or SSB to start with?

I am not sure what you mean by "better off." Assuming license class is not a consideration (you have more than a Novice license), try operating both and see what you like. Sideband initially takes less effort to operate but the frequencies are more crowded during prime operating hours. You usually can do better with DX on CW without fighting everyone's kilowatt.

What if I want to join a QSO that is already under way?

Let's be very blunt about it. In some cases, you won't be welcome. Hams are a cross section of people, no more and no less. However, on CW, a simple "BK" is enough to be invited in. On SSB, "May I join you? This is WA1WTB" or any English language equivalent is acceptable. Be careful of using "Break."

What is the problem with "Break?"

It used to be the normal and accepted way to break in but recently, especially on repeaters, "Break" or "Break Break" is used to indicate an emergency situation when you want to transmit in a hurry.

Is repeater operation different from other types of QSOs?

Yes. Almost every area or repeater is slightly different. It is a good idea to listen for a while before you get on a new repeater. Almost all are equipped with a timer which will cut you off if you talk for more than 1, 2, or 3 minutes, depending on the setting.

What controls the timer? I really don't want to get cut off in mid-sentence.

Some timers reset as soon as the repeater's receiver no longer receives a carrier. Others reset as soon as the repeater's transmitter shuts off. Some repeaters transmit a beep tone when the timer has been reset (see Fig. 2).

FREQUENCY	TRANSMITTER Preselect or Driver	Plate	Load	TUNER/MATCHBOX Input Cap	L	Output Cap
3700						
3750						
3800						
7000						
7050						
7100						
7150						
7200						
21000						
21100						
21200						

Fig. 3. Sample tuning chart.

Why limit the time for transmitting?

The primary reason is to force a pause between transmissions, and to do so often enough to allow anyone who wants to join the QSO time enough to transmit his call. In addition, it allows mobile stations to get into the repeater without having to wait any longer than a minute or two.

Do mobile stations have a priority?

Usually yes—both on repeaters and elsewhere. First, they are limited by their motion as to how long they will stay in range. Second, they are more likely to have seen an emergency situation or to need directions or other aid. Good procedure again follows common sense—let a mobile in quickly to find out if he has a problem.

I hear a lot about "kerchunking" repeaters. What is the story here?

Kerchunking is a very common practice of pressing your mike button to see if your transmitted signal is strong enough to bring up a repeater. Since it is a transmission without identification, it is technically illegal but it is also generally a worthless test. Quite often you can be on the fringe area of a repeater and be able to bring the repeater up but be too noisy to copy.

Is there a better way?

Sure. Key your mike and identify by saying, "This is WB1AJG—is anyone around?" If you don't make the repeater, nothing is lost. If you do make the repeater and no one answers, it doesn't make any difference since you won't have anyone to talk to!

When I identify myself on a repeater, should I use phonetics?

With a little experience you will know the answer to that question for your own call. If it contains an F, S, or other easily confused letter, you can use phonetics, but it is not usually done unless the station you are talking to does not repeat your call correctly. The same holds true for signal reports—they are not usually given unless asked for or you wish to indicate a problem.

Which signal reports are usually given on repeaters? Q5 S9 does not seem appropriate.

Since the signal strength you are receiving is due to the repeater and not due to the station you are talking to, the best you can do is tell if you are copying OK ("full quieting") or noisy. Some hams will say "50% quieting" which indicates they are copying half noise and half signal, but this non-technical use of "quieting" is a wild guess at best.

What about reports on other bands or when you are not using a repeater?

I suggest telling the truth. On CW, if you had a transmitter problem and your tone was not T9 or perfect, wouldn't you want the other guy to tell you? The

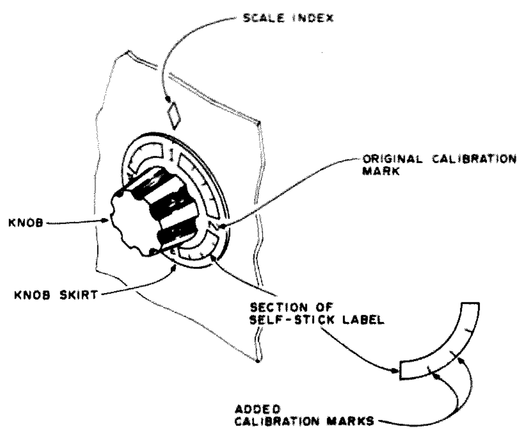


Fig. 4. Adding calibration marks to a skirt-type knob.

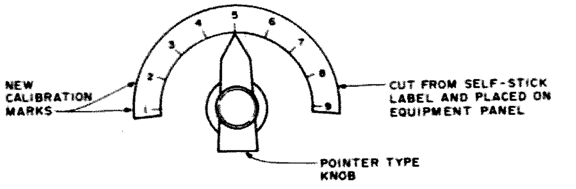


Fig. 5. Adding calibration marks to a pointer-type knob.

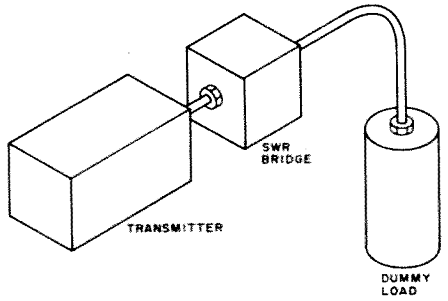


Fig. 6. Step 1: Tune up the rig into a dummy load.

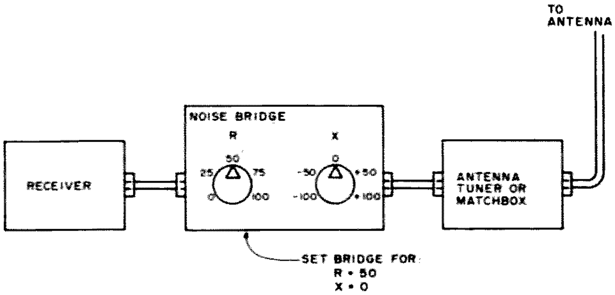


Fig. 7. Step 2: Adjust tuner to provide a 50-Ohm load.

same holds for asking the other ham to QRS or slow down.

Frankly, I was hesistant to ask. Won't a request to QRS brand me as a beginner?

Possibly, but we were all beginners once. Besides, what is the sense of sending "R" (I have solid copy) when you don't have the foggiest idea what the other station was talking about? I would rather be considered a ham who just is not too fast on CW than the character who sends: "R R R solid copy here OM please repeat your name, QTH, and my report." Besides, there are real ways to be branded a beginner.

For example?

Break into an emergency net when you cannot contribute anything. Keep making unsolicited, helpful suggestions to the station controlling the situation. An experienced ham would say nothing and listen carefully. If the net control station wants help, he will ask for it specifically.

Any other common things to avoid?

Sure. If you want to sound silly in the middle of a QSO, give out with an extended "H-E-L-L-O-O-O-O" to check your plate current or output power. Think how you must sound on the other end. If you feel absolutely compelled to make a check in mid-QSO, simply say to the other guy, "excuse me," put your rig in tune, and make a quick check. However, putting out a carrier for an extended period of time is a great way to be unpopular and cause unnecessary QRM. Besides, it's pretty rough on your finals.

I guess I don't understand. If I have to tune my rig and match it to the antenna, I have to transmit a carrier.

Yes, but you don't have to transmit it for very long. There are at least two ways to handle this problem. The first is to make up a tuning chart for your rig (and antenna tuner if you use one). Record the dial readings as you tune up every 50 or 100 kHz. Now, when you change frequency from one end of the band to the other, just set your knobs to the chart and you will only have to tweak them slightly to tune up, which can be done in 2 or 3 seconds (see Fig. 3).

Some of the knobs on my rig have calibration marks every quarter of a revolution. Is this good enough to allow me to preset them?

Probably not, but you can ink-in additional lines on the knob or use sections of self-stick labels. Place a small piece of self-stick label on the knob skirt (Fig. 4) or on the panel (Fig. 5) with the additional calibration marks inked in. Plain white paper fastened with rubber cement is also durable and easily removed later. If you draw lines on the paper or labels, you can protect them with artist's fixative or varnish.

What is the second way of tuning up without transmitting a carrier for an extended period?

Actually you can tune up without transmitting a carrier at all. It takes three pieces of equipment: your swr bridge, a dummy load, and a noise bridge. First, connect your rig (Fig. 6) through the swr bridge to a dummy load, and at the frequency you want to operate, tune up your rig into the dummy load. Then, connect the noise bridge as shown in Fig. 7 and set the resistance control on the noise bridge to 50 Ohms and the reactance control to zero Ohms. Next, tune your antenna tuner or matchbox for a minimum noise as heard in your receiver. If you have a transceiver, be very careful not to transmit with the noise bridge in the line or it will go up in a very rapid puff of smoke.

Now, remove the noise bridge and reconnect the transmitter through the swr meter to the antenna tuner, and you are ready to operate. What you have done is tuned your transmitter to its design condition of maximum power out into a 50-Ohm load, and you have made the antenna tuner and antenna look like a 50-Ohm load. Connect the two (Fig. 8) and you are ready to transmit, with maximum power out. You can also use this technique to make up a tuning chart so that you have to go through the procedure only once for each 50- or 100-kHz band segment you like to operate in. ■

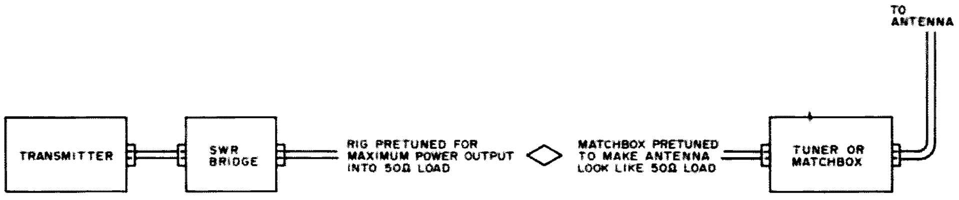
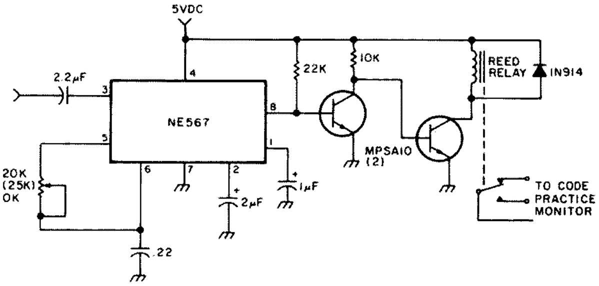


Fig. 8. Tuned up—without ever transmitting through the antenna.

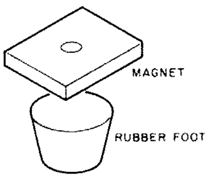
CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

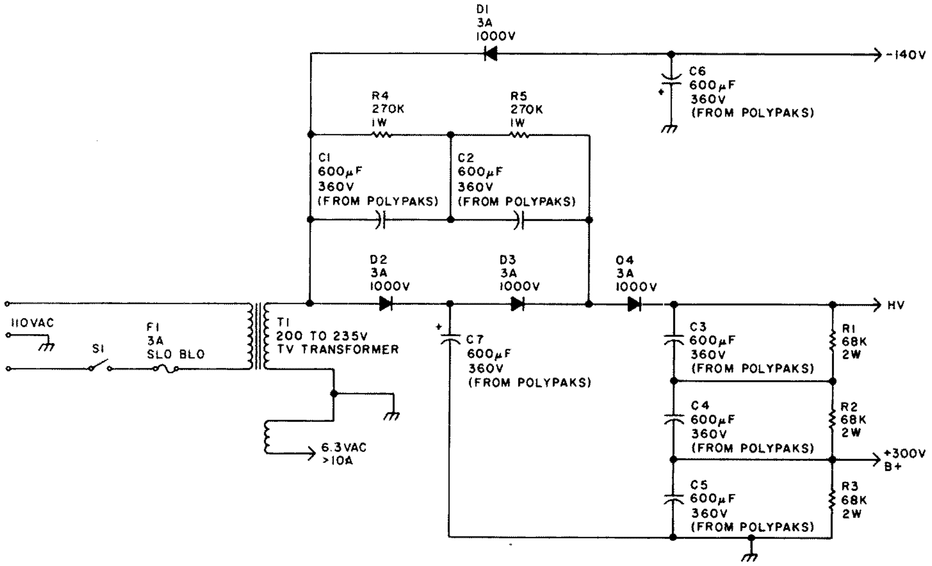
In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73* Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*



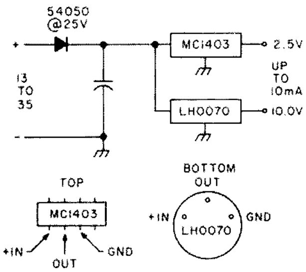
CW FILTER: This filter features a 40-Hz bandwidth and no ringing. To use it, tune your receiver so that the code-practice oscillator duplicates the signal you want to copy.—Ronald Folkert, Benton Harbor MI.



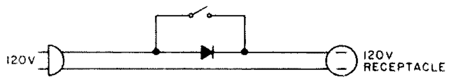
REMOVABLE MAGNETIC FEET: Gear such as Drake's TR-22C is fine for mobile or portable use but often lacks refinements like rubber feet that make it suitable for use in the shack. My solution to this deficiency was to epoxy several small magnets to some rubber feet and then stick them to the bottom of the radio. When the rig goes portable, just remove the feet. If you don't have any magnets handy, you can remove some from the magnetic cabinet latches sold in hardware stores.—Thomas Hart AD1B, Westwood MA.



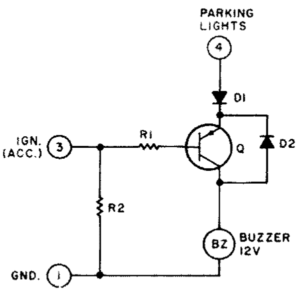
SUBSTITUTE TRANSFORMER FOR HEATH GEAR: The power transformer found in many newer TV sets can be used with a voltage-doubler circuit to provide up to 450 volts dc, as well as bias and filament voltages. I used this approach to replace the transformer in a Heathkit HX-10; it also should be suitable for the SB and HW series of Heath radios. (Note: Your rig's wiring may need to be modified if it has 12-V filaments.)—Terry Martin, Carrollton GA.

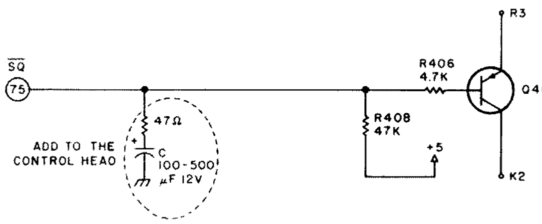


SIMPLE VOLTAGE STANDARD: This circuit gives you a voltage standard to check your VOM or electronic voltmeter. The MC1403 will deliver 2.5 volts while the output of the LH0070 is 10 volts. Both sources are accurate to one percent or better. You can get other voltages by using different members of the MC140X and LH007X precision regulator series. The diode can be anything rated over 40 mA and 60 volts piv.—J. T. Miller N6BM, Yucaipa CA.



HEAT CONTROL FOR A SOLDERING IRON: This handy circuit allows you to reduce the temperature of a soldering iron. Just place a diode in series with one side of the ac line. You can easily switch the control in and out by shorting the diode. The polarity of the diode doesn't matter. I used a 1N2070 diode rated at 400 volts, 0.75 Amperes. Any similar diode will do.—H. H. Hunter W8TYX, Columbus OH.





SCAN DELAY FOR THE AZDEN 2000: By adding a capacitor and resistor to the Azden 2000's control-head circuitry, you can have a delay before the receiver resumes scanning. There is approximately one second of delay for each 100 uF of capacitance added.—Hiam Sandel KB2IV, Flanders NJ.

HEADLIGHT REMINDER: If your headlights or parking lights are on, there will be 12 volts on terminal 4. If the ignition is off, terminal 3 will be at ground. When these two conditions are met, the transistor is turned on and the buzzer sounds. KA5CRI/9 suggests that this circuit can be built into a surplus seat-belt buzzer.—Steve Stout KA5CRI/9, Palatine IL.

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

CW REMEMBERED

Like it or not, we are witnessing the twilight of the CW era. After more than a century as a mainstay of electrical and electronic communication, CW is on the way out.

I make this statement purely as a rational observation. Nobody (including Wayne) has forced me to this conclusion. Just look at the facts. Thanks to microelectronics, radiotelephone transceivers need be no larger in size than CW-only rigs. Computer generated digital communication has now reached a point where it is inexpensive and portable. It's also faster and more reliable than code. CW—except as a means of personal enjoyment—is washed up.

Apparently, the FCC agrees with this point of view. Shortly you'll see the Commission remove the CW requirement from the Tech license. After that, it's just a matter of time (the year 2000 sounds good) before the feds eliminate all code requirements. In an age of 1s and 0s, dits and dahs don't make sense. Just as CW replaced spark, computerized communication techniques will replace CW.

By now your getting the feeling that I hate CW. Not at all. I've pounded the brass with the best of them. It's just that I, like most true radio amateurs, look forward to new challenges. And CW, while fondly remembered, should be relegated to the dusty attic of ham-radio history.

This month, we look back at CW and reflect upon the contributions it has made to our hobby. And if any of you have anything to say about what I've written about CW, remember: I passed a 20-wpm code test. Can you say the same?

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) What the "wave" in question is
6) As opposed to amateur (abbr.)
8) *QRN silencer (abbr.)*
9) Hams can't be this
11) FCC rule section
13) Not down
14) Telegrapher's slang for shift
16) Slash
17) 3.14
18) CW term of affection
19) CW chuckle
20) Learning code is this
22) Ham organization
24) ARRL's Stan
25) Jammer
26) Some say CW does this
29) ARRL brasspounding position (abbr.)
30) No code ops?

Down

1) Points on a key
2) Pressing a key
3) Weak signal place to noise
4) Early code mode
5) CW subband location
7) US President's initials
10) End of message (abbr.)
12) A bug is semi- __ __
14) Weary while sending
15) CW noises
21) Old 160 bother
23) Vibroplexes
24) Sometime key plating
25) On-air organization
27) Negative charge
28) Traffic organization (abbr.)

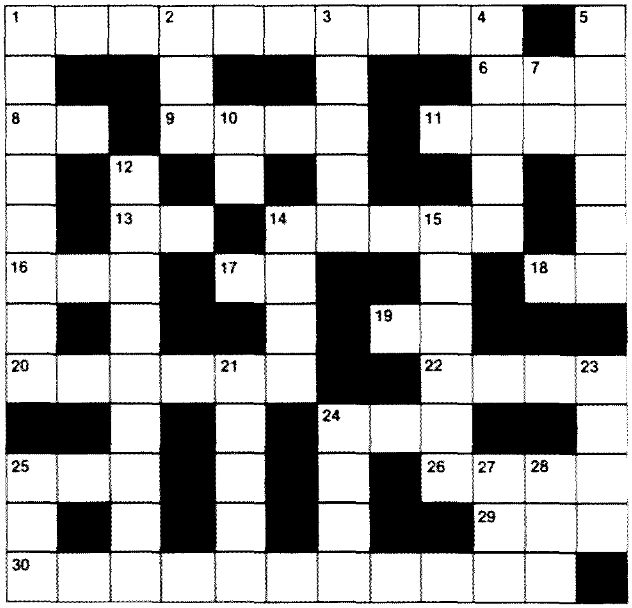


Illustration 1.

ELEMENT 2—MULTIPLE CHOICE

1) *Samuel F. B. Morse, father of telegraphy, was a man of many talents.* At the time he invented the telegraph, what was his profession?
   1) Professor of art at New York University
   2) Electrical engineer
   3) Lab assistant to Thomas Edison
   4) Professor of theology at Yale

2) What were the first words transmitted via code?
   1) Testing one, two, three
   2) Hello, Watson. Can you hear me?
   3) Greetings from the President.
   4) What had God wrought!

3) The inventor of the Vibroplex semiautomatic key was:
   1) Hugo Gernsback
   2) Horace G. Martin
   3) Thomas Edison
   4) Clarence Tuska

4) What did Hiram Percy Maxim name his favorite spark transmitter?
   1) Sparky
   2) *Old Betsy*
   3) Little Darling
   4) The ARRL Special

5) What device was used on telegraph lines to create an audible sound at the receiving end?
   1) Heterodyne beater
   2) Sounder
   3) Beat-frequency oscillator
   4) Mechanical audio oscillator

ELEMENT 3—TRUE-FALSE

	True	False
1) C. W. McCall was the inventor of "continuous waves."		
2) Samuel F. B. Morse invented the continental code.		
3) The initials F. B. in Morse's name stood for "Fine Business."		
4) It's legal to send continental code on US ham frequencies.		
5) The FCC officially banned spark transmissions in 1954		
6) Our end of message signal—AR—is nothing but the American Morse letters FN meaning "Finish."		
7) The "Glass Arm" is the top award presented by the Society of Wireless Pioneers.		
8) Barry Goldwater K7UGA is the ham who introduced the League's "Tune in the World" CW practice tape.		
9) The first memory keyer used six relays.		
10) At one time, the Extra-class ticket required proficiency at 25 wpm		

ELEMENT 4—SCRAMBLED WORDS

GUB	BONK	YEKDROAB
CCNOTTA	GRINSP	KCILC
YREKE	SIFT	DESEP
	IGHTEWING	

THE ANSWERS

Element 1
See Illustration 1A.

Element 2
1—1 They always said that learning the code was an art.
2—4 Funny. Morse didn't include God as a co-inventor in his patent.
3—2 What! you didn't know this one?
4—2 The League still has it in its museum.
5—2 Click. Click-click. Click.

Element 3
1—False. He wrote that crummy CB "Convoy" song.
2—False. American.
3—False. Finley Breese.
4—True. Why not? It's the one the FCC tests us on.

5—False. 1927.
6—True. You learn something new every day.
7—False. A "glass arm" is a weary arm.
8—False. Jean Shepherd K2ORS did the honors.
9—True. Developed in 1953, the "Ultimatic" used six relays. No microchips then.
10—False. It has always been pegged at 20.

Element 4:
(Reading from left to right) BUG, KNOB, KEYBOARD: CONTACT, SPRING, CLICK; KEYER, FIST, SPEED; WEIGHTING

C	O	N	T	I	N	U	O	U	S	■	B
O	■	■	A	■	■	N	■	■	P	R	O
N	B	■	P	A	I	D	■	P	A	R	T
T	■	A	■	R	■	E	■	■	R	■	T
A	■	U	P	■	T	R	I	C	K	■	O
C	U	T	■	P	I	■	■	L	■	O	M
T	■	O	■	■	R	■	H	I	■	■	■
S	I	M	P	L	E	■	■	C	L	U	B
■	■	A	■	O	■	Z	A	K	■	■	U
N	U	T	■	R	■	I	■	S	I	N	G
E	■	I	■	A	■	N	■	■	O	T	S
T	E	C	H	N	I	C	I	A	N	S	■

Illustration 1A.

SCORING

Element 1:
Twenty-five points for the completed puzzle, or one-half point for each question correctly answered.

Element 2:
Five points for each correct answer.

Element 3:
Two and one-half points for each correct answer.

Element 4:
Three and one-half points for each correct answer.

How well do you remember CW?

1-20 points—Not at all
21-40 points—Vaguely
41-60 points—Failed 13 wpm twice
61-80 points—CW buff
81-100 + points—A1 Op Club Member

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I need an L6 passband tuning coil (part #K42031-1) and an L1 bifilar coil (part #K42032-1). Both are for the Hallicrafters HC-10 converter. Call me collect at (907)-733-2447 or contact me at the address provided.

Jack Norris
Box 321
Talkeetna AK 99676

I am looking for a meter for a Knightkit VTVM made by Allied Radio Corporation and a meter for a Simpson 260 VOM (20,000 Ohms-per-volt). Anyone having either of these two items, please contact me.

Guy A. Elder WB5JEV
1316 Main Street
West Point KY 40177

I need the schematic diagrams and owner's manual for the Knightkit T-150A transmitter and the R-100A receiver. I will pay all postage and copying costs.

Antonio V. Villaneuva
c/o Mrs. Erlinda V. Pastrana
7218 Belinger Court
Springfield VA 22150

I need the schematic and manual for a Knightkit color pattern generator, model KG-685. I will pay for copying and postage. Thank you.

John C. McKee
1127 Vernie
Alton IL 62002

Does anyone have a recent list or roll tube chart for the Hickok 539B tube tester? It should be no more than 2 or 3 years old if possible.

Marvin Moss W4UXJ
Box 28601
Atlanta GA 30328

NEW TS830S for $150?

Yes indeed! Just add a Matched Pair of top-quality 2.1KHz BW (bandwidth) Fox Tango Filters. Here are a few quotes from users:

"... Makes a new rig out of my old TS830S!..."
"...VBT now works the way I dreamed it should..."
"...Spectacular improvement in SSB selectivity..."
"...Completely eliminates my need for a CW filter..."
"...Simple installation - excellent instructions..."

The Fox Tango filters are notably superior to both original 2.7KHz BW units but especially the modest ceramic 2nd IF; our substitutes are 8-pole discrete-crystal construction. The comparative FT vs Kenwood results? VBT OFF — RX BW: 2.0 vs 2.4; Shape Factor: 1.19 vs 1.34; 80dB BW: 2.48 vs 3.41; Ultimate Rejection: 110dB vs 80. VBT SET FOR CW at 300Hz BW — SF 2.9 vs 3.33; Insertion Loss: 1dB vs 10dB.

OPTIONAL CONNECTIONS

Fox Tango filters for RX and TX; Fox Tango for RX - Kenwood for TX; FT for RX - switch-select FT or K for TX; switch-select FT or K for RX/TX.

INTRODUCTORY PRICE: (Complete Kit)...$150
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Shipping $3 (Air $5). FL Sales Tax 5%

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Box 15944S, W. Palm Beach, FL 33406
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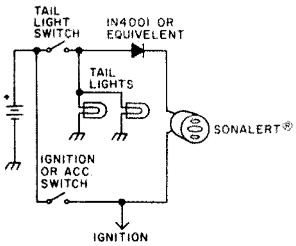
*Tandy Corporation

✓See List of Advertisers on page 130

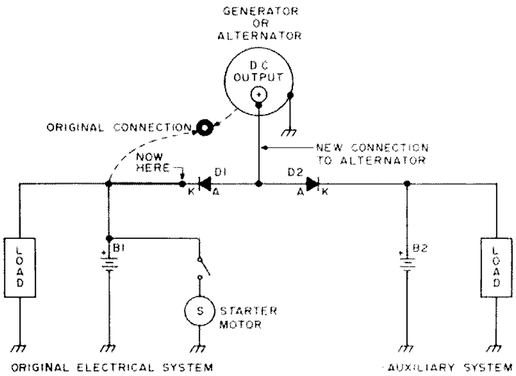
CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

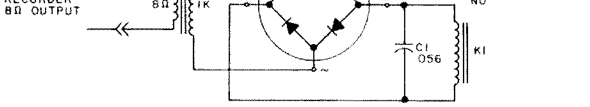
In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73 Magazine, Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*



SIMPLIFIED HEADLIGHT REMINDER ALARM: The circuit uses just two components, one silicon diode and one Sonalert™ (4-28 V dc). Both of these items can be purchased surplus. The diode is a prevention device, protecting the signaling device and ensuring that the ignition switch is isolated from the circuit.—Richard S. Shepard AI5H, San Antonio TX.



DC AUXILIARY SYSTEM WITH ISOLATION: Presented here is a simple auxiliary battery system. Battery B2 is isolated from the primary battery by diode D2, and D1 is protected as well. Both diodes should be at least 40 Amperes forward current, and 50 to 100 piv. A heavy wire from the junction of the two anodes connects to the charging device terminal. Do not *rewire so that D1 is between the battery and the starter motor.*—A. W. Edwards K5CN, McAllen TX.



AUTOMATIC CQ CALLER: Record and send CQ or CQ DX—or any message—cheaply and easily. Begin by recording your message on a cassette tape. This recording will be used to drive the circuit. Mount the full-wave bridge astride the relay (K1). Solder the + and common leads to the coil leads. T1 is Superglued to K1. The assembly can be mounted inside a transceiver or outboard in a box. Wire the relay output to the keyjack. Install a jack to receive the audio output from the cassette. Endless-loop cassettes are available from Radio Shack. Five-minute cassettes are available from Pyramid Data Systems, 6 Terrace Ave., New Egypt NJ 08533.—Dave Nesbitt WD4AAW, Decatur GA.

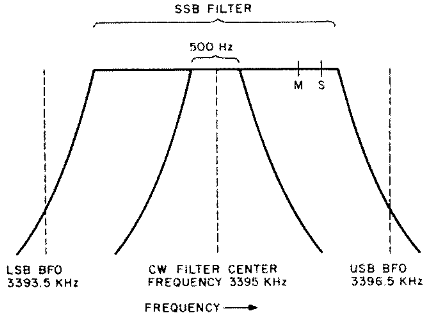


Fig. 1.

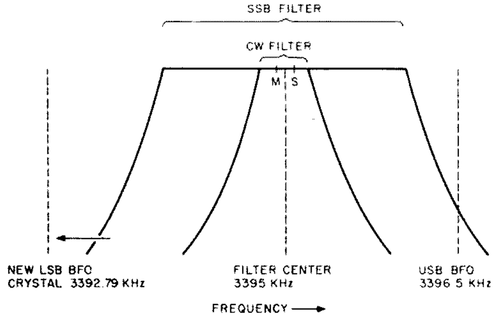


Fig. 2.

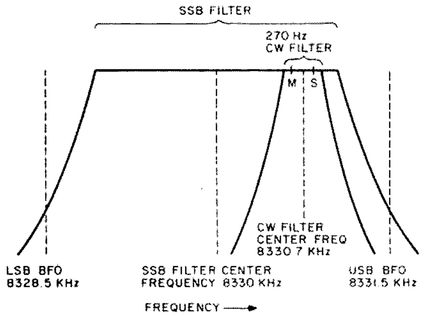
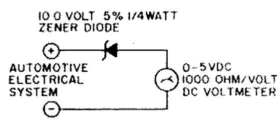


Fig. 3.

MODIFICATION TO THE KENWOOD TS-520S FOR AFSK: Fig. 1 shows the passband of the Kenwood TS-520S. By installing a crystal with a frequency of 3392790 Hz, the RTTY tones of 2125/2295 Hz will be right in the middle of the filters' respective passbands. See Fig. 2.

Fig. 3 shows the i-f filters. When installing the 270-Hz filter, follow the directions given in the manual except for the following: 1) install the filter in the SSB narrow position; and 2) jumper lead "A" to the "SSN" position and jumper lead "B" to the "SSB" position.

To set the filter, turn the switch to "CAL" and tune for a 2210-Hz tone (a scope is helpful, or else tune to a null on your RTTY tuning meter).—Richard Kulaga KA9EDX, Fond du Lac WI.



AN INEXPENSIVE EXPANDED-SCALE VOLTMETER: Use an unsealed 0-5-V-dc 1000-Ohm-per-volt meter movement. Solder a 10.0-volt, 5%, ¼-Watt zener diode to the positive meter terminal (this is located under the case). Use as short as possible a lead for good mechanical stability, observing zener polarity. Change the numbering on the meter face to 10-15 V dc. Use either a razor-pointed marking pen or dry-transfer numbers. Reassemble the meter and test it before installing it in your car. To ensure greatest accuracy, pre-check the zener and make certain that it is as close as possible to 10.0 volts.—Alan Christian WA6YOB, San Jose CA.

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received at 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458.

DEARBORN MI
NOV 4

Encon Corporation, in cooperation with Solarex Corporation, will provide a free photovoltaic (electricity from the sun) seminar at 7:30 pm on November 4 at the Dearborn Hyatt Regency, Dearborn MI. A talk on the history, production, and applications of solar cells will inform and educate all those who attend. For reservations, contact Encon Corporation, 27584 School Craft Rd., Livonia MI 48150, (313)-261-4130.

SOUTH GREENSBURG PA
NOV 6

The Foothills Amateur Radio Club will hold its annual Swap and Shop on Saturday, November 6, 1982, at St. Bruno Church, South Greensburg PA. Tickets are $2.00 each or 3 for $5.00. There will be an indoor flea market and food. Talk-in on 146.07/.67 and .52/.52. For more details, contact Mario Carrera W3TTN, or write FARC, PO Box 236, Greensburg PA 15601.

SELLERSVILLE PA
NOV 7

The R. F. Hill ARC will hold its 6th annual hamfest on November 7, 1982, in the Sellersville National Guard Armory, Sellersville PA. Doors will open at 7:00 am for sellers and 8:00 am for buyers. There will be refreshments and heat. Talk-in on .28/.88 and .52. For further information, contact R. F. Hill ARC, Box 29, Colmar PA 18915.

CONCORD NC
NOV 7

The Cabarrus Amateur Radio Society, Inc., will hold its annual hamfest on November 7, 1982, from 9:00 am to 5:00 pm, at the Concord Boys Club, Spring Street, Concord NC. Admission tickets are $2.50 in advance, $3.00 at the door. Flea-market tables are $4.00; table space is $2.50. There will be bingo for the ladies, speakers, and forums. Hot food, beverages, and free parking will be available. Talk-in on 146.655. For advance tickets, flea-market tables, or space, send a check to CARS, PO Box 1290, Concord NC 28025.

NORTH HAVEN CT
NOV 7

The Southcentral Connecticut Amateur Radio Association's (SCARA's) third annual electronics flea market will be held on Sunday, November 7, 1982, indoors at the North Haven Recreation Center on Linsley Street in North Haven CT. Regular admission is $1.25; children under 12 with an adult will be admitted free. Sellers' spaces are $6.00. The best spaces will be assigned first. A limited number of free tables will be provided to the first reservations received. When those tables are gone, space will be available for selling from the floor or from your own table. Food will be available. Sellers may set up at 8:00 am, and walk-ins will be admitted from 9:00 until 3:00. For reservations, send check or money order payable to "SCARA" to Ed Goldberg WA1ZZO, 433 Ellsworth Avenue, New Haven CT 06511. Include an SASE for confirmation.

BANGKOK THAILAND
NOV 12-14

The Radio Amateur Society of Thailand (RAST) will hold the 12th annual South East Asia Network Convention (SEANET 82) on Friday, Saturday, and Sunday, November 12-14, 1982, at the Imperial Hotel, Bangkok, Thailand. There will be lectures, discussions, and commercial exhibits. For more details, contact RAST Secretary, PO Box 2008, Bangkok, Thailand.

NEWMARKET ONT CANADA
NOV 13

The York Region ARC will hold its annual flea market on Saturday, November 13, 1982, from 0800 to 1400 EST, at the Newmarket Community Centre, Newmarket, Ontario. Doors will open at 0630 for exhibitors. General admission is $2.00 (children will be admitted free of charge if accompanied by an adult). Refreshments will be available. Exhibitors' tables are $2.00 each. Talk-in on 142.52 (VE3YRA) and 147.225/.825 (VE3YRC).

FORT WAYNE IN
NOV 14

The Allen County Amateur Radio Technical Society, Inc. (AC-ARTS), will hold the 10th annual Fort Wayne Hamfest on November 14, 1982, at the Allen County Memorial Coliseum, Fort Wayne IN. Admission is $2.50 in advance and $3.00 at the door; children under age 11 will be admitted free. Regular tables are $6.00 and premium tables are $20.00. The Coliseum charges a $1.00 parking fee. Doors will open to the general public at 8:00 am and for vendor setups at 5:00 am. For further ticket or table information, write Becky Skinner KA9GWE, 9720 Pinto Lane, Fort Wayne IN 46804.

BILLERICA MA
NOV 20

The Honeywell 1200 Radio Club and the Waltham Amateur Radio Association will hold their annual amateur radio and electronics auction on Saturday, November 20, 1982, at the Honeywell Plant, 300 Concord Road, Billerica MA (exit 27 off route 3). Doors will open at 10:00 am and admission and parking are free. There will be a snack bar and a bargain parts store. Talk-in on 147.72/.12 and 146.04/.64. For more information, contact Doug Purdy N1BUB, 3 Visco Road, Burlington MA 01803.

CANTON OH
NOV 21

The Massillon Amateur Radio Club (W8NP) will present Auctionfest '82 on November 21, 1982, at the Nazir Grotto Hall, 6th and Dueber Avenue SW, Canton OH. Advance tickets are $2.50; at the door, $3.00. Doors will open at 7:00 am for setups and 8:00 am for others. The auction will start at 11:00 am. Talk-in on 146.52. For advance tickets or tables, contact Steve Nevel WD8MIJ, 1864 Massachusetts Avenue SE, Massillon OH 44646.

GREENSBORO NC
NOV 27-28

The Greensboro Amateur Radio Club will hold the second annual Greensboro Hamfest on November 27-28, 1982, at the National Guard Armory, Greensboro NC. The hours will be 9:00 am to 5:00 pm on November 27th and 9:00 am to 3:00 pm on November 28th. Pre-registration before November 12, 1982, is $3.00 and registration at the door is $4.00. There will be tables and tailgating available. Talk-in on 145.25, .19/.79, and .52. For pre-registration (please include an SASE) or more details, contact Russ Brandt KE4KL, 1301 Dayton Street, Greensboro NC 27407.

STONY BROOK LI NY
NOV 28

The Radio Central Amateur Radio Club will hold its fourth annual Ham-Central, 1982 edition, on Sunday, November 28, 1982, in the main social hall of Temple Isaiah, 1404 Stony Brook Road, Stony Brook LI NY (about 50 miles east of New York City). Doors will open at 7:30 am for sellers and dealers and at 8:30 for the general public. Admission is $2.00 and XYLs and children under 12 will be admitted free. Nine-foot tables are $5.00 each and half tables are $3.00. Features will include an updated antenna lecture by Art (W2LH) and Madeline (W2EEO) Greenberg, home-cooked hot food, and drinks. Talk-in on 144.550/145.150 (WA2UEC) and 146.52. For additional information, maps, and advance reservations, contact Scotty Policastro KA2EQW, 80 7th Street, Bohemia NY 11716, (516)-589-2557, or Bob Yarmus K2RGZ, 3 Haven Court, Lake Grove NY 11755, (516)-981-2709.

HAZEL PARK MI
DEC 5

The 17th annual Hazel Park Amateur Radio Club Swap and Shop will be held Sunday, Dec. 5, at Hazel Park High School, Hazel Park MI. Hazel Park High School is located on Hughes Street at 9½ Mile Rd., 1 mile east of I-75. Tickets are $1.50 in advance or $2.00 at the door. Tables are $1.00 per foot. Doors open at 8:00 am. Plenty of food and parking will be available. Talk-in on 146.52. For tickets, table reservations, and information, send an SASE to Hazel Park Amateur Radio Club, PO Box 368, Hazel Park MI 48030 or telephone (313)-398-3189.

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✓179

DON'T TIME OUT... TIME IN *Introducing Toggle Time*

Model TI-10 time alert for repeater operators to avoid timing out repeater. (PATENTED) *Sensitive enough for HT's *Automatic; Senses RF carrier-no connection to rig *Battery powered *Resets on carrier drop-out *Adjustable timing period *Size 5 1/4×3 5/16×1 3/4 *Weight 8 oz./226.8 Grams Piercing, 6.5 KHz alert tone

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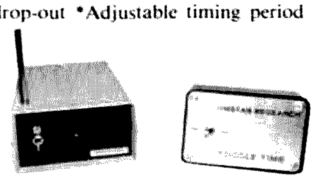
Printed Circuit Board and Documentation........$15.00



Toggle Time is a 10 minute timer that would be utilized by a ham to keep within FCC 10 min. ID rules. It is actuated by a toggle switch which serves two purposes:

✶ Begins timing period when power is applied.

Dealer Inquiries Invited ✶ When Toggle Time times out it lets you know with a loud tone. Price $14.95

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COMSTAR RESEARCH *P.O. BOX 771 Madison Heights, MI 48071*

✓See List of Advertisers on page 130

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ALARA CONTEST

Starts: 0001 GMT November 13
Ends: 2359 GMT November 13

Sponsored by the Australian Ladies' Amateur Radio Association, the contest is open to all licensed operators and SWLs throughout the world. YLs work everyone, OMs work YLs only. All bands may be used, phone and CW combined. Each station may be worked twice on each band—once on phone and once on CW. All contacts must be made in accordance with operator and station license regulations. No net or list operations, no crossmode, and no repeater contacts may be claimed.

EXCHANGE:

ALARA members send RS(T), serial number starting with 001, and ALARA number and name. Others (YL nonmembers or OMs) send RS(T), serial number starting with 001, and name.

FREQUENCIES:

Phone—3570-3590, 7100-7120, 14280-14300, 14180-14200, 21350-21370, 21180-21200, 28480-28520.

CW—3525-3535, 7010-7020, 14050-14060, 21125-21135, 28100-28110.

SCORING:

On phone—10 points for ALARA club stations contacted (VK2DYL or VK3DYF), 5 points for ALARA members, 3 points for YL non-members, 1 point for OMs.

On CW—double all point values shown for phone.

For SWLs—5 points for ALARA members logged and 3 points for YL nonmembers logged.

AWARDS:

Certificates will be awarded to the top scoring ALARA member in each country and VK call area; top scoring YL nonmember, OM, and SWL on each continent; and the top scoring VK Novice.

ENTRIES:

Send a single log containing date/time in GMT, band, mode, callsign worked, report and serial number sent/received, name of operator of station worked, and points claimed. Logs must be signed and should show full name, callsign, and address of operator along with final score claimed. Logs must be legible, either typed or printed, no carbon copies please. No logs will be returned and the decision of the contest manager will be final. Logs must be received by the contest manager by Dec. 31st. Address entries to: Mrs. Margaret Loft VK3DML, 28 Lawrence St., Castlemaine, Victoria, Australia 3450.

EUROPEAN DX CONTEST—RTTY

Starts: 0000 GMT November 13
Ends: 2400 GMT November 14

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operation out of the 48-hour period are permitted for single-operator stations. The 12 hours of nonoperation may be taken in not more than three periods at any time during the contest. Operating classes include: single operator/allband and multi-operator/single transmitter. Multi-operator/single transmitter stations are only allowed to change band one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 through 28 MHz. A contest QSO can be established between all continents and also one's own continent. However, QSOs as well as OTC traffic with one's own country are *not allowed!* Each station can be worked only once per band.

EXCHANGE:

Exchange the usual six-digit number consisting of RST and progressive QSO number starting with 001.

SCORING:

Each QSO counts 1 point. Each QTC (given or received) counts 1 point. Multipliers will be counted according to the European and ARRL countries list. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. However, contacts within the same continent only count as a multiplier of one per band (including 80 and 40 meters). The final score is the total QSO points plus QTC points multiplied by the sum total multipliers.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to another station—the general idea being that after a number of stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported, i.e., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. A maximum of 10 QTCs to a station is permitted. You may work the same station several times to complete this quota but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the contest committee are final. It is suggested to use the log sheets of the DARC or equivalent. Send a large SASE to get the wanted number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than December 15th to: DARC DX Awards, PO Box 1328, D-895 Kaufbeuren, West Germany.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HB0, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1346, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, 9H1.

DELAWARE QSO PARTY

Starts: 1700 GMT November 13
Ends: 2300 GMT November 14

Sponsored by the Delaware ARC. Stations may be worked once per band and mode for QSO and multiplier credits.

EXCHANGE:

QSO number, RS(T), and Delaware county, ARRL section, or country.

FREQUENCIES:

CW—1805, 3560, 7060, 14060, 21060, 28160.

SSB—1815, 3975, 7275, 14325, 21425, 28650.

Novice—3710, 7120, 21120, 28120.

SCORING:

Delaware stations score 1 point per QSO. Multiply total by the number of ARRL sections and DX countries worked.

Others score 5 points per Delaware station worked. Multiply total by the number of Delaware counties worked on each band and each mode (maximum of 36 multipliers possible). The three Delaware counties are: Kent, New Castle, and Sussex.

ENTRIES & AWARDS:

Appropriate awards will be given to the top scorers. In addition, a certificate to all stations working all three Delaware counties. If you work all three counties and want the WDEL Award, send two 20-cent stamps and an address label. Mail logs by December 17th to: Charlie Sculley AE3H, 103 E. Van Buren Avenue, New Castle DE 19720. Send an SASE for a copy of the results.

SANDUSKY RADIO EXPERIMENTAL LEAGUE QSO PARTY

Starts: 1800 GMT November 13
Ends: 1800 GMT November 14

The 50th Anniversary of the Sandusky (Ohio) Radio Experimental League, Inc., will be observed and celebrated with a QSO party while members of the club operate on five amateur bands using the club call, W8LBZ. Frequencies will be: 28150 and 7125 for Novices; 3740, 7040, 14040, 21040, and 28040 on CW; 3910, 7265, 14280, 21360, and 28600 on phone. All frequencies plus/minus 10 kHz.

YELLOW THUNDER SMOKE SIGNALS

NEWSLETTER CONTEST WINNER

This month's winner is *Smoke Signals*, published by the Yellow Thunder Amateur Radio Club of Baraboo WI. The layout is superb and the articles are written in a humorous, low-key style. The newsletter is full of excellent news items from around the nation and overseas, making it appear more like a nationally-based newsletter. Also, a schedule of all the traffic nets in Wisconsin is included. The paper is full of interesting items, such as fox-hunt rules and updates on the members' activities. The editor, Jim Romelfanger K9ZZ, has done an outstanding job.

To enter your club's newsletter in our contest, send a copy to: Editorial Offices, *73 Magazine*, Peterborough NH 03458.

CALENDAR

Nov 6-7	ARRL Sweepstakes—CW
Nov 13	Australian Ladies' ARA Contest
Nov 13-14	European DX Contest—RTTY
Nov 13-14	W8LBZ QSO Party
Nov 13-15	North Carolina QSO Party
Nov 13-15	CQ-WE Contest
Nov 20-21	ARRL Sweepstakes—Phone
Nov 20-21	Trinidad and Tobago QSO Party
Dec 4-5	ARRL 160-Meter Contest
Dec 11-12	ARRL 10-Meter Contest
Dec 19	CARF Canada Contest
Jan 8	*73 Magazine* 40-Meter Worldwide SSB Championship
Jan 9	*73 Magazine* 80-Meter Worldwide SSB Championship
Jan 15-16	*73 Magazine* 160-Meter Worldwide SSB Championship
Jan 15-18	Hunting Lions in the Air Contest

All amateurs worldwide are invited to participate. A special QSL card/certificate will be sent to all who send their QSL card to the QSL Manager, W8LBZ, 2909 West Perkins Avenue, Sandusky OH 44870.

CQ-WE CONTEST

Starts: 1400 GMT November 13
Ends: 0500 GMT November 15

Sponsored by the Bell System Amateur Radio Fraternity, the contest is open to present and retired employees of Bell, Western Electric, AT&T, and subsidiaries of AT&T. Contact local interworks coordinator for logs and complete rules, or write Steve Wheatley WN8GUE, Bell Laboratories, 2525 Shadeland Avenue, PO Box 1008, Indianapolis IN 46206. Telephone: (317)-352-2442 at work or (317)-545-4029 at home.

NORTH CAROLINA QSO PARTY

1700 GMT November 13 to 0200 GMT November 14
1200 GMT November 14 to 0100 GMT November 15

This year's party is sponsored again by the Alamance ARC (K4EG). The same station can be worked on each band. Crossband and repeater contacts are not permitted.

EXCHANGE:

RS(T) and NC county or ARRL section.

FREQUENCIES:

SSB—3980, 7280, 14280, 21380, 28580.
CW—60 kHz up from lower band edge.
Novice/Tech—20 kHz up from lower band edge.

SCORING:

NC stations count one point per QSO and multiply total by sum of ARRL sections.

Others count 2 points per NC contact and multiply total by number of NC counties worked (100 max.). Add a bonus of 25 points for working the club station, K4EG.

AWARDS:

The top scorer in and out of state will receive the 1983 *Callbook* of his/her choice. Certificates to top scorers in each ARRL section.

ENTRIES:

Send logs and summary sheets showing essential details to: F. R. Ashley WB4M, 2731 Blanche Dr., Burlington NC 27215. Include large SASE for results. Mailing deadline is December 13th.

TRINIDAD AND TOBAGO QSO PARTY

Starts: 0000 GMT November 20
Ends: 2359 GMT November 21

The 9Y4 OSO party has been organized by the Trinidad and Tobago Amateur Radio Society, Inc., to commemorate 20 years of independence, 5 years as a republic, and 50 years of amateur radio. Use all bands from 10 through 160 meters on SSB, CW, or via satellites.

EXCHANGE:

The usual 5- and 6-figure serial number signal report plus a progressive 3-digit number starting with 001.

AWARDS:

A certificate will be awarded to any station working 5 or more 9Y4 or 9Y5O stations.

ENTRIES:

Logs must show date/time in GMT, station worked, and number sent/received. It is requested that a remittance of $2.00 or IRC equivalent be included with your log if you are eligible for an award. Entries must be postmarked no later than December 21st and addressed to: TTARS, PO Box 1167, Port of Spain, Trinidad, WI.

RESULTS

1982 SPRING BARTG RTTY CONTEST RESULTS

Single-Operator Section

No.	Callsign	Points	Total QSOs
1.	W3EKT	666196	373
2.	EA8RU	518560	343
3.	W3FV	504648	276
4.	G3HJC	462870	221
5.	I2OLW	462384	336
6.	I1TXD	430560	272
7.	SM6ASD	405958	261
8.	W4CQI	400044	242
9.	I2WEG	384948	252
10.	WB3CCZ	376516	218

Multi-Operator Section

No.	Callsign	Points	Total QSOs
1.	G3ZRS	513540	270
2.	LZ1KDP	505310	321
3.	OH2AA	431600	314
4.	G3UUP	299936	216
5.	I4JXE	282906	193

Shortwave Listener Section

No.	Name/Call	Points	QSOs
1.	OK-1-12880 (Czech SWL)	282534	187
2.	Y2-10521/0 (DM SWL)	130052	98
3.	Y2-6346/K (DM SWL)	95256	76
4.	NL4483 (PAO/SWL)	91276	121
5.	J. Matthews (USA)	63680	60

LETTERS

FEEDBACK

I know you like feedback, so here comes a long-postponed letter.

I still believe your magazine is the best all-around ham publication, but the cost is starting to concern me. You needn't defend it again. I'm fully aware that costs are continually rising. However, the saddle-staple binding of the July, 1982, edition definitely upset me. Is there an article shortage? Or are costs that high?

Speaking of articles, I had a few good ideas for short articles, but I fooled around and someone beat me to the punch—three times. Keep encouraging us to write. Even short articles are always interesting and often useful.

I particularly enjoy those about ham radio history and electronic history in general. I really loved that series your dad wrote a few years ago. Is it available in book form? By the way, how is the old gentleman?

In defense of your feelings about the code test, the July issue proves you have nothing against CW. I found the articles presented a fresh approach to some old gadgets, my favorite part of ham radio.

Incidentally, I preferred the table of contents cover when looking up old articles but I have enjoyed most of the photo covers also. My favorite was probably the chess board made up of vacuum tubes back around 1967. I once suggested a cover picture of sculpture made from the junk box. You did that a few years ago, too. I'm now working on a chess game from solid-state devices.

Another positive comment. No other magazine I have ever seen prints such an excellent mix of letters—pro and con—no matter what the subject.

Finally, I was very excited about the Braille DX Service ("Letters," July) but no address was given. I would like to pass this info to some sight-impaired friends. Could you please publish it?

Tom Grabowski K3SPY
Baltimore MD

Thanks, Tom. I don't think I get to a hamfest at which someone doesn't push me to get the Ancient Aviator articles by my father into book form. Our book division is working on this, although I'd like to get Dad to write more about some of the dirty work which went on during the time he was starting the first transatlantic airline. He's doing well at 86, spending half of his time in northern New Hampshire and half in New York. He really should write more. The saddle stitching is a little less expensive than the perfect-binding style, but the main reason for changing was our re-emphasis on construction articles. The saddle-stitched magazine lies flat on the workbench for reading or building, while the perfect bound style flops itself shut all the time. I've been pushing the fun of building gadgets for over 30 years now and I don't intend to stop. CW? The only thing I have against it is its being mandatory. I am convinced that if we made it a matter of ham pride, we would have more CW than ever. Many hams are obstinate people like me... as long as I am forced to do something they can go to hell. Call it Yankee perverseness, if you like.

The address you're looking for is BDXS, 8347 W. 6th Ave., Lakewood CO 80215; (303)-233-4335.—Wayne.

INNER PROCESSES

It is enjoyable to read such a practical and informative article as "Electric Health via Negative Ions" by Michael Windolph (July, '82). I especially liked the sensible statement, "Know what you are doing and be careful!"

I wanted to bring up a side point that might be of interest to your readers. To a large extent, we have become so accustomed to harmful environments that we have lost touch with our original, instinctive intelligence. It can be regained by patient, hard, and dedicated work, but it does take time.

To fully regain our instinctive intelligence to *know* when something is wrong, we must not only adjust our physical environment but also place our inner life in order. I find best-selling author Vernon Howard's books very helpful in this respect. Mr. Howard tells us that we have played a wrong note for so long that we have forgotten what the right note should sound like.

Using negative ions to enrich our air is 100% practical. To combine such simple and helpful projects on the practical level with intense observation of our inner processes would lead to better understanding of both worlds.

Keep up the good work. I look forward to every issue.

Tommy Russell
Boulder City NV

GEARVAKf

I can't tell you what a pleasant surprise and thrill it was to read that *The GEARVAKf Bulletin* had been selected Newsletter of the Month for August. It's gratifying to know that our "peculiar brand of madness" is appreciated by you folks out there in the real world of amateur radio publishing.

The *Bulletin*, of course, is a labor of love (we sure as hell don't make any money at it). It had its beginnings back in the distant past when my co-conspirators and I decided that too many hams, ham organizations, and ham publications tended to take themselves much too seriously. We started to poke fun at them—and ourselves—through the *Bulletin*.

We recognize that there is a serious side to amateur radio, but *The GEARVAKf*

Bulletin gives people a chance to take a "time out." With limited funds and distribution, we'll continue our periodic wackiness as long as possible. Your recognition has given us a chance to increase our readership some, and perhaps momentarily lighten the lives of our brother and sister hams. It helps us, too. Editing the paper is real therapy!

Anyway, on behalf of Dr. Felix R. Onehundredton, Dr. Elwood P. Lishnus, Dr. Avruell U. Harnishe, Ti-Grace Gaboon, Lelah Lilah Lowlou, and the rest of the GEARVAKI ruling mob, thanks from the bottoms of our warped little hearts.

Joe Ventolo, Jr. K8DMZ
Editor
The GEARVAKI Bulletin
Enon OH

SACRIFICES

Re Mr. Richardson's letter in the August *73* about rude tendencies in ham equipment salespeople:

I was formerly employed with one of the largest ham equipment dealers in the US, and I'd have to say that what he says is true to a certain extent. But give the guy behind the counter a break—there are a few legitimate reasons.

First, the salesguy is making a big sacrifice for the sake of his job; he has probably given up being an active ham. You can't talk, think, and eat ham radio all day and go on the air after work! No way. You get burned out sooner or later. Secondly, it was my experience that the amount of immature, rude nerds is disproportionately high in the ranks of hams as compared to the general population. Woe to the salesman who sold a guy an HT that breaks after a week!

I've had a guy threaten to kill me for refusing to return his money on a defective transceiver! If you take a radio in for service many times, you'll get incessant calls about its status until it's fixed, as if it'll get fixed faster while the serviceman is busy on the phone. So many hams go *berserk* when they don't have their daily radio fix, you wouldn't believe it!

You see guys come in, clamp a pair of headphones on and space out for hours listening to the Yamaguchi on display—without spending a dime. How many businesses would put up with that? If you politely tell them to leave, they get mad as heck. Hey, what can you otherwise do?

Finally, I ended up getting pretty darned disgusted with the technical ignorance of many hams of late. We had to wire dozens of mike plugs, even for Extra-class hams. As a salesman, you were expected to constantly give advice on how to hang antennas, read an swr bridge, or zero-beat a CW signal. That's fine to a certain extent, but so many wouldn't take the time to pick up an antenna manual to find out, even to maybe learn something. Why? If you are so damn lazy you memorized the Bash books to get your license, you're not about to read the ARRL antenna book to learn how to cut a dipole (which you should have known how to do in the first place). No, keep taking the easy way out and ask the radio shop guy.

So, after all this and more, a sincere guy or a beginning ham might come into a radio shop and just might get a little shortshrifted. Sorry, guys.

Name and address submitted

P.S. Please withhold my name from print. I might decide to go back into the ham business after all. (Where's my valium?)

By golly, you're not trying to tell us that you think that knowing the code isn't all that's needed? All these nerds who have been driving you crazy have passed the code test, so what are you beefing about? They may have an Extra-class license and be able to copy code at twenty per, but they can't wire a mike plug, eh? Well, that's what most hams want us to have, my friend, so stop beefing. Until I see some Bash books in shreds at ham stores I will continue to believe that most hams don't want anyone to know any theory . . . or how to build even the simplest of stuff . . . or to know one end of an antenna from the other. Your customer stories are the same as I'm hearing from all of the ham dealers. I've been pushing for a change from depending on the damned code to a real technical test, not a Bashed one. . . . with no noticeable success.—Wayne.

KEEP THE CODE

In response to your comments about having a no-code license, I was under the impression that amateur radio was developed "to provide a voluntary, non-commercial service that provides for emergency communications, the advancement of the state of radio art, and a trained pool of operators, technicians, and electronics experts (97.1.)"

Well, it seems to me that if we are to follow this rule we should go out of our way as licensed hams to help people become trained operators of CW. As you well know, CW can be heard when voice communications cannot be understood. Because of this, CW can be utilized much more efficiently during emergency situations.

I teach at the Virginia School for the Deaf and Blind in Staunton, Virginia. Two 14-year-old girls, both visually impaired, passed both parts of the Novice requirements this year and received their call letters (KB4AHA and KB4AGZ). For those who feel that the CW portion of the Novice exam is *too* hard, especially those who claim to be skilled enough to pass the technical portion of the Extra-class exam, I would like to have them talk to these two girls and the other 400-plus-thousand licensed hams across the United States.

In closing, if the no-code license is approved, the only people who will benefit are the 2-meter-rig manufacturers and those who don't really care enough about ham radio to take the time to learn one of the most important and useful aspects of amateur radio . . . CW.

William F. Bowman KA4UFI
Staunton VA

Well, Bill, what you say was true thirty years ago . . . maybe even twenty years ago. But you're so out of date with current technology that I don't know where to start. Apparently you are unaware of RTTY, which has been around for well over 30 years on the ham bands. You seem not to know about recent developments such as integrated circuits, digital electronics, and so on. Yes, in the days of spark, everything you've written was true. Alas, we still have a surprising number of hams who are living isolated in the old spark days.—Wayne.

PRICED OUT

These days, most countries, particularly Canada, have serious money problems, but even in our poor economic condition we haven't been reduced to the point where we have an official ½-cent coin.

I know the true value of our penny may not even be worth half of its face value, but it seemed very funny to me to see on the cover of your August, 1982, issue #263 that the price of the magazine was printed as $2.49½.

Either the proofreader missed it, or you have decided to print an error deliberately to see how many people really read it "from cover to cover."

ALSO THIS ISSUE!

R. Ian McAuley VE3MYO
Alexandria, Ontario

We have an opening for a new proofreader . . . any takers?—Wayne.

LAID OUT

Your new cover layout for the August issue of *73 Magazine* is great. Plus, I was glad to see that the articles were more in line with the *73* of a couple years ago. I was beginning to have my doubts about *73*, as the articles seemed to be getting away from ham radio somewhat. Having been a subscriber to *73* in excess of ten years, I hope the August issue is an indication of better ham radio articles to come.

Now, if you could just come out with a blockbuster RTTY issue like you did a couple of years back!

Vince Statlo WB2FYZ
Ilion NY

The September issue was packed with RTTY goodies, and let me make it perfectly clear (to coin a phrase) that I think that the future of hamming is tied in with digital communications . . . and that's RTTY. I want to publish articles on higher and higher-speed digital communications, on error-correcting code systems, on automatic relaying, and so on. If enough of us chip in (pun), perhaps we can set up some international relay system which will be of immense value in emergencies. We might even think about an organization which could be called the International Radio Relay League! The mind boggles. Anyway, glad you enjoyed the issue, and yes, we'll be having a lot more interesting construction projects.—Wayne.

NO THANKS

Just a short note to state that I have, over a period of 4 or 5 or 6 months, helped upwards of 50 hams and others through your "Ham Help" column (particularly on older receivers, transmitters, etc.).

Sad to say, only about 8 have even bothered to reply and thank me, or at least tell me to "get lost."

Kind of makes you wonder.

Roy H. Wilkinson
Bloomington MN

P.S. I have a much better "batting average" with the readers of Popular Electronics' "Operation Assist" column. Also, I miss your "want ads" column!

Roy, the place for your ham ads is in a ham ad paper, not a magazine. It takes about three months to print a ham ad in a magazine and by that time the stuff is usually sold. The ham ad papers get the ads out there in a couple weeks and do a nice job of it. I really hate to take bread out of the mouth of small entrepreneurs by competing with them in 73, so I urge all readers to use the specialty publications and keep them healthy. I wish that QST would do that, too. You'll note that we don't try to compete with CQ magazine and their specialized coverage of contests. Sure, there are only a couple thousand hams who are seriously interested in contests, but those who are should read and support the publication dedicated to them . . . which is CQ. I don't know what to say about the ungrateful cretins who get help and then say nothing.—Wayne

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

One of the questions raised a few months back regarding the design of a radioteletype receive program was how to make such a receiver immune to garbage or noisy signals. This month I'll take a look at one technique which can be used to overcome such a problem: multiple sampling.

Recall that each data pulse in a 60-wpm Murray character, of which there are five, lasts for 21 ms. Mechanical teleprinters do not use the entire pulse, but rather a small sample of it. Where this sample window is positioned depends upon the adjustment of the range selector. That is, only a small slice of each data pulse is read in order to determine whether that pulse is a mark or a space. Fig. 1 shows how this window overlaps the longer data pulse. Since mechanical printers time the "intra-pulse" interval from the position of the window on the data pulse, advancing the window toward the beginning of the pulse will enable the next pulse to be read that much sooner and can allow speeds slightly greater than 60 wpm to be read. It is by using this technique that so-called "66-speed" machines can be copied on an otherwise unmodified Model 15.

In an analogous fashion, simple RTTY receive programs such as those described here in the past sample each data pulse only once and use that information to reconstruct the Murray character. With the routines presented a few years ago, for example, a momentary sample from the middle of each pulse was obtained. A delay of 20 ms between samples kept the windows positioned near the middle of each data pulse.

The difficulty with such a scheme is that noise or fading can distort individual pulses within a character, thus changing the interpretation. A simple solution is to look at each pulse not just once, but several times, and base the decision of what to call that pulse on the sum of those samplings. Regular samples can be taken at, say, two-ms intervals to produce a time scheme such as shown in Fig. 2.

Having sampled each pulse many times and presuming we have stored that infor-

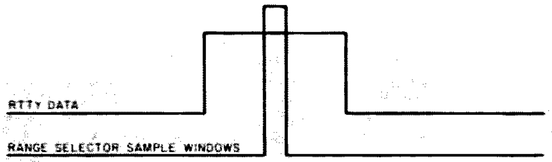

Fig. 1. The sample window.

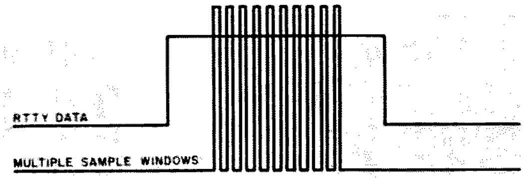

Fig. 2. Computer's multiple samples.

mation in some usable format, we must now decide what to do with that knowledge. Unless the circuit being monitored is an absolutely clear channel, it is doubtful that all ten (in this example) samples will be identical. In the case of pure noise, one might expect an average of half mark and half space, so a threshold would seem appropriate to adjudicate when to call a given pulse "mark," when "space," and when to throw it out. For want of a better suggestion, let's settle on seven or more samples one way or the other to label a state. Reading less than seven pulses of either mark or space will render the individual bit trash.

So you have a trash pulse, now what? It would seem that there are at least two ways to deal with that. Either you arbitrarily assign it as a mark or space and take your chances with the character, or you decide the entire character is lost and just loop out the time. The latter appeals to me the most; after all—garbage is garbage, no? In order to implement that, all you would need to do is keep track of how many bits you have read and delay whatever is left to get to the next stop bit.

I don't know how confusing that all is when you read it; it was not all that clear in the writing. I think that Fig. 3, a flowchart of what I am talking about, will help clear things up, though. The character reception routine is entered with a bit counter set at five, the number of pulses in a Murray character. After detection of a start pulse, additional counters for mark and space are set up and cleared. A loop is entered to sample each pulse ten times and register the state of the pulse sampled in the appropriate counter. After ten samples have been taken, the counters are examined to determine the probable identity of the pulse and record that in the correct position. Assuming all has gone well thus far, the sampling process is repeated for each of the five data bits, and the Murray character transmitted is recovered.

However, what if a bit is in error? What I have directed here is to trash the entire character. We do that by branching to a routine which waits out the remaining bits' time and then exits with a null for the received character. One presumes that the translation scheme used will ignore such a character.

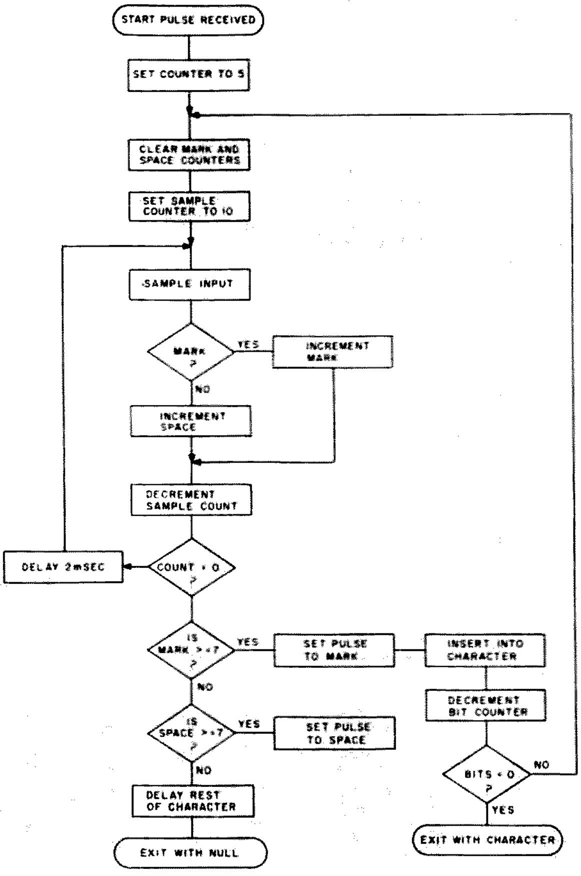

Fig. 3. Multiple sample flowchart.

This type of scheme is useful for eliminating erroneous characters where the error is generated between transmission and reception. For those errors generated on the operator side of the keyboard, you are on your own!

Turning to the mailbag, I have a note here from Leo F. McAuliffe, Jr., of Ashland, Massachusetts, who is a shortwave listener interested in copying RTTY. Leo is looking for a device which will display received RTTY on a TV screen, without having to invest a lot of money. Well, Leo, as you may have appreciated in the pages of ads here in *73*, there is not a lot on the market to do what you ask. Those units that are commercially available cost several hundreds of dollars, which you indicate is out of your range. I might suggest two possible alternatives. One would be to scout the hamfests in your area for an older, used, video RTTY unit, such as an old Microlog receiver. These were made some years back and should be turning up for reasonable prices on the flea-market circuit. Another idea is to put together a small unit yourself, using a dedicated computer, costing under $100, and an ASCII video display. Such displays may be old terminals or receive display boards, none of which should cost too much. For some time and elbow grease, you may be quite happy with what you will come up with. If there is sufficient interest, I would be willing to work out the design of such a unit. Let me know with, as they used to say on the tube, your cards and letters.

Among the new arrivals here at WA3AJR is another computer, an Atari 400. I bought it for the kids, but you know who is at the keyboard more and more. I am impressed by the programmability of this unit and hope that we will be able to use it on ham radio. I will keep my eyes open for applications, and I hope you do, too. I look forward to sharing with you whatever we all can discover in future columns.

Next month, some more investigations into the design of the ideal RTTY terminal program, as well as a look at what some of you are saying. Winter is a great time to work in the shack, even though these new transistorized/ICized rigs don't put out the heat of a pair of 807s. Let's see what kind of things we can do in next month's RTTY Loop.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

THE TOP TEN

What are the Top Ten? No, not the best selling rock-and-roll records, but the most sought-after countries in the DX world. Every year *The DX Bulletin* surveys the top DXers in this country and other countries to determine which countries are most needed. *The DX Bulletin* concentrates on those DXers with more than 250 countries worked and is the most prestigious of all the bulletins. Its Top 73 list is the most complete and well-respected of any such list in the world. Some amateur radio manufacturers determine who will receive DXpedition rigs on the basis of this survey. *The DX Bulletin* recently granted permission for this column to reproduce the 1982 list of the most needed countries. Here is the list, with comments on future amateur radio activity. (For further information on *The DX Bulletin*, write 306 Vernon Avenue, Vernon, Connecticut 06066.)

1. *China BY.* China tops everyone's most wanted list, with almost no legal amateur radio since the early 1950s. But that is changing (see this column, July). More BY stations are coming on the air, and BY will move down the most wanted list in future years. Not rapidly, but it will slowly move down until everyone has worked BY.

2. *VK/Heard.* This tiny rock near Antarctica will host one or two major DXpeditions in 1983. Watch Heard drop completely off the most wanted list next year.

3. *VU/Laccadives.* The only island worth landing on in this archipelago is the base of considerable pirate activity. No, not radio pirates, but real life pirates who don't leave live victims. No one in his right mind goes anywhere near the Laccadives.

4. *Albania ZA.* It's the political climate that keeps amateur radio out of Albania. As one of the poorest of the Eastern European countries and one close to the Soviets, Albania has taken a dim view of ham radio for years. There are signs of a softening of this attitude, however, and rumors continue to fly of a DXpedition to Albania any day now. Don't hold your breath, but don't hesitate to work any ZA you might hear.

5. *Cambodia XU.* Political turmoil and civil war preclude ham radio from Cambodia. Official permission is unlikely in the near future; we'll just have to wait until things calm down.

6. *South Yemen 7O.* A similar case to Albania. South Yemen is in the Soviet camp, and they don't endorse amateur radio.

7. *Bouvet 3Y.* Another tiny island near Antarctica, Bouvet sees occasional tourist and scientific traffic. Permission from Norway can be obtained, and Bouvet might well be a target of a DXpedition soon, but probably not this winter.

8. *Andamans VU.* At least one amateur is listed as having a license for the Andamans, but activity has been non-existent. The Indian rules prevent outside amateurs from getting licenses, and the locals don't seem to show enough interest in activating one of the rarest of all DXCC countries.

9. *Burma XZ.* The official Burmese government says "No" to any amateur radio, and the ARRL refuses to accept the operations from the "rebel" north half of the

A gaggle of FO8s. Did you work 3 FO8 stations on two different bands during their Tiurai celebration July 14-22? If so, you qualify for a special award, but you must request the award before the end of the year. 15 active FO8s made more than 5000 QSOs during the celebration. (FO8GM photo courtesy of WB6GFJ.)

country. This political mess shows no signs of being straightened out in the foreseeable future.

10. *San Felix CE0X.* Getting a license is trivial (I have one), but getting onto the island is impossible. The entire island is a military base (like Aves in the Caribbean) and "gringoes" are not welcome. Even the Chileans have been unable to convince the military higher-ups that they mean no harm in their planned DXpedition. A recent "operation" from San Felix turned into a fiasco when the Chileans claimed the operator was nowhere near the island at the time. This could break at any time, but I rate it doubtful.

The main difference in this list from a similar one twenty years ago is in the reasons for lack of activity from a country. Twenty years ago the reasons were physical inaccessibility and lack of transportation and accommodations in the country. It's hard to mount a DXpedition when you have to pack your gear, generators, and fuel in on camels. The transportation picture has changed for the better, and no spot on this earth is out of reach of a determined amateur.

But the political realities have changed for the worse. Certain cheats and frauds in the last 20 years and increasing sensitivity to feelings in developing countries have led to a more formal approach to the documentation needed for a DXpedition to "count" for DXCC. The conservative attitude of the ARRL DXCC staff means an amateur cannot simply operate from a country; he must be welcomed by that country and operate with their full cooperation. This is simply impossible in many countries. Many emerging countries are reluctant to put *anything* down in writing, although they are eager to give verbal permission to operate.

Another reason for the reluctance of countries to permit even visiting amateurs to operate is the fear of spying, internal revolt, or outside takeover, all of which require radio communications. Unsophisticated customs officials cannot differentiate between spy gear and a TS-830. (On second thought, are there any real differences?) So it is simpler always to say "No" than to see if it is possible to say "Yes." We probably won't see this attitude change quickly. Only patient demonstrations and years of support, documentation, and assistance will win jittery governments over to the value of amateur radio, as we see happening in China.

What does this mean for the DXer? If you want to get on the Honor Roll (having worked almost all the DXCC countries), you must have patience. It may be many years before we see significant radio operations from many of the Top Ten.

If you do hear one of these highly desired countries on the air and are fortunate enough to work it, the battle is only half over. Now you have to get a QSL card to prove you worked him.

QSLS AND QSLING

There is more to DXing than working the DX station; getting the confirmation of the contact can be every bit as challenging as breaking through the pileup. But a few hints and suggestions can substantially improve your QSL percentage and get some of those coveted pasteboards "on the wall."

In this first part of this series on QSLing we will consider the card itself: the selection, design, and printing of your own QSL card. In future columns we will advise how to fill out the card, how to get the card to the appropriate place, and QSL bureaus.

Your Personal QSL Card

There are no rules requiring that acknowledgement of a DX contact must be in the form of a postcard-sized paper. QSL means acknowledgement of a contact, not a special card. But *everyone* who seeks those acknowledgements uses the universally accepted QSL card. In more than 100,000 requests for my QSLs, I have *never* received a request without such a card. Only a tiny handful have been other than postcard-sized. So while there are no formal requirements for the dimensions of the QSL, I recommend sticking to the standard format.

Choosing Your Card

Given the transient nature of most DX QSOs, the DX station has little opportunity to get to know you. If the QSLing is handled by a QSL manager, the person filling out your return card will know even less about you. So your QSL card reflects your personality and amateur radio interests even more than your DX contact.

When the time comes to choose your QSL card, you first have to decide on a custom card or an off-the-shelf commercial card. There are dozens of commercial QSL card printers. Most offer a set of samples and designs for a nominal fee. Once upon a time the QSL printers would obtain the FCC list of new licensees and send you a set of samples and order forms before you even received your license! You were so pleased to learn your callsign that you immediately ordered 1000 of their fanciest cards. 950 of these are probably still gathering dust in your basement.

The advantages of commercial QSL printers are many. They produce a good looking card at relatively small expense. The card is easily recognizable as a QSL and it is printed on stock heavy enough to go through the mail as a postcard. Prices range upward from a few cents a card. You can select from a bewildering variety of cards, including multi-colored cards, two-sided cards, and more. Ordering your commercial QSLs is trivial: You pick your design, fill in the blanks on the form, and send in your money. You will get your cards back in a few weeks—longer if you use one of the smaller printers.

But for DXing, standard QSL designs have one major disadvantage: They are all the same. No, not identical, but an active DX station who receives thousands of QSLs each year will have seen dozens or hundreds of similar cards. Your card will be one of the pack; it won't stand out. Some hams try to make their cards stand out by using bright orange QSLs that glow in the dark. I still see spots before my eyes from opening an envelope with one of these Day-Glo orange QSLs. But I have received bunches of these, too. Certain QSL designs are so popular that I have received hundreds of cards identical except for the callsign. Needless to say, I am not intrigued to receive yet another one of the same design.

This doesn't mean that standard design QSLs end up in the circular file. It just means that they get answered just like any other QSL, no faster or slower. The call and the individual operator will not be remembered any length of time.

The cards (and operators) who do stick in the mind after the QSL is answered are those personal cards, cards which say something about the ham and his station.

If you do decide on a commercially-produced, standard QSL card, there are a few things to keep in mind when making your selection. First, avoid commercially-produced two-sided cards. These are the cards with the personal information on one side (callsign, name, and address) and a standard QSL form on the reverse. Why avoid these? The DX station must first find your QSO in his log. This means comparing the time of the QSO on the back of the card and the callsign on the front with his pages and pages of log. Sometimes the card must be flipped several times before the QSO is located in the log. Then, in order to fill out the return card, the DX operator must first record the QSO information and then turn the card over to get the callsign. Big deal, you say. How difficult is it to turn the card over? Flipping one or two or ten or a hundred cards is no big deal. But when you deal with thousands and thousands of cards, the QSLer soon learns to dread the sight of another two-sided card.

Two-sided cards also lead to possible errors on your return QSL. In the process of flipping the card, the DX station might forget the call, or transpose two letters, etc. The result might be a QSL card which will be rejected by the DXCC checkers.

This does not mean that all two-sided QSL cards are useless for DX purposes. There is nothing wrong with a card which has the call and name on one side and the QSO information on the reverse, *as long as the callsign also appears on the reverse.* Then the DX station (or QSL manager) doesn't have to flip the card; the callsign is right there on the reverse with the QSO information. But few commercially-available two-sided cards offer this option. It requires custom printing of *both* sides of the card, greatly increasing the costs, and eliminating many of the economies of scale of QSL printing. So if you intend to do a lot of DXing, stick with single-sided QSL cards.

Another thing to check when you purchase commercial cards is the glossy finish. Many of these very handsome and attractive finishes will not absorb ink from felt tip pens. The ink puddles up and smudges off. Hard pencils may make a very light trace on some coated cards. Test your sample cards with your usual writing utensil. Does the pen make a clear, clean impression which doesn't smear? Not all shiny cards have this problem; you have to check the sample.

Another possible problem with commercial QSLs is the use of strange typefaces. Some amateurs choose an exotic typeface for their callsign and address, one that is different, on the hope that it will make their standard card more distinctive. Don't! These weird typefaces are often difficult to read. Typefaces that look like script or brush strokes are especially difficult to read. What difference does it make, you ask? If your callsign is difficult to read, the DX station might get it wrong. Then he might not find it in the log, or he might fill out your QSL to someone else's call! For the same reason avoid those ubiquitous silver-on-black QSLs. They are very difficult to read!

Custom QSLs

I personally prefer custom-designed QSLs, both to send and to receive. I feel the QSL card is an extension of your amateur radio personality, and it should say something about you and your *amateur* career. Custom-designed QSLs need not be elaborate or expensive, and the initial effort quickly pays off in improved returns.

What should go onto your personal QSL? Make sure you have the basic information: your callsign, name, and address including county. You will also need blanks for the QSO information. If you work one mode or band predominantly, you might want to customize the QSO information. For example, a 20-meter enthusiast might have "Freq. 14 _______MHz." Be sure to say that this card is a confirmation of the QSO described; many commercial cards omit this vital line.

I have used both the box format and a sentence format for the QSO information, and I definitely recommend the former. The sentence format (i.e., "This confirms our 2X_____QSO on _____ on _____MHz at_____UTC, with your signals _____ RST.") is cumbersome and very prone to error. The box format is clean and easy to fill in and read. Amateurs seem to be able to make the simplest task complicated and so produce a bewildering number of combinations of these QSO information boxes. For consistency and to assist the person filling out the return card, I suggest the following format: Callsign, Date, UTC, MHz (not band), 2X(mode), RST. If you are designing your own card from scratch, be sure to leave enough space in each of the boxes for the required information. In other words, the boxes for the callsign and date should be substantially larger than those for the other information. Better yet, take a blank QSL with well-designed boxes and steal the format.

Another important item to include on your custom QSL is a request for the DX station's card. You would be amazed at the number of QSLs I have received without such a request. Since I receive and

send thousands of cards each year, I do not answer cards that don't have a specific request for my card; I assume the card is an answer to a card I sent. By the way, avoid those cute QSLs with the QSO information hidden on a drawing of a rig, etc. Anything that makes the QSO information hard to find or decipher will slow up your return card.

So much for the nuts and bolts of OSL card design. What about the overall look? What personal information will customize your OSL? A photograph of yourself at your operating position with QSLs and awards in the background says more about you than any amount of text. A good photograph shows your equipment, station layout, your most prized awards, and (very important) adds a face to your call. My favorite QSLs to receive are definitely photographic QSLs, because they say so much about the operator without listing hundreds of awards no one has ever heard of.

The major drawback to a photographic OSL is the considerable initial expense. But if you can find a friend who will take a good black-and-white photograph, you can save a good part of the cost. There is usually at least one good photographer in every radio club.

What about listing your equipment and antennas on the OSL? Every time I have done this, I have changed the gear as soon as the cards come back from the printer. If you trade your equipment regularly and try new antennas every season, you should leave the listing of gear off the card. If you are satisfied with your Collins gear and Big Bertha, by all means list the equipment; the DX station is always interested in knowing what produced that strong signal.

Once your card is designed, there remains the choice of how to print it. Some of the QSL printers will produce a custom card from your sketch, but expect to pay for their services. I prefer the quick-print approach, as I usually print many thousands of cards at a time, and the quick-print shops will produce a card for less than a penny apiece. I provide camera-ready copy and the printer prints four cards on each sheet of paper and cuts them into QSL-sized cards. (Postal Service requirements insist on a certain minimum size for postcards; check this before you have the cards trimmed. Also make sure your card will fit into a standard small envelope without folding.)

Whatever format or type of OSL card you select, you still have to fill it out properly, get it to the correct individual, and get his card back. We'll discuss these other steps on QSLing in future months.

AWARDS

GLADESPEDITION

The Fort Myers Amateur Radio Club will be conducting a "Gladespedition" to Glades County, Florida. Operations will begin on November 13, 1982. W4LX will be operating in the General bands, both CW and SSB. Some Novice contacts will also be made. If you need Glades County, be sure to look for them. QSL to: David Fox KA8CXQ, PO Box 051131, Tice FL 33905. SASE please.

45th PARALLEL

The Tri-County Wireless group will mini-DX from Gaylord, Michigan, on the 45th parallel (halfway between the equator and the north pole) from 1400Z November 13 through 0600 November 14. Phone only at 3.925, 7.250, 14.300, 21.375, and 28.550. Certificate for QSL and SASE to N8COY.

ABC-TV

The ABC-TV Washington Engineering Group, celebrating the first year of operation from the network's new Washington news bureau, will be on the air Saturday, November 13, from 1400Z to 2200Z, on SSB frequencies (plus or minus 5 kHz): 7.245 and 14.285 and on CW for Novice and Technician contacts on 7.125 (listening at 45 minutes past each hour). KB7ZZ/3 will also be on 145.190 FM (W3DOS/R) throughout the operation period. Special events QSLs via business-size SASE to: Steve Malis KA4ORL, 2520 Heathcliff Lane, Reston VA 20091.

JERSEY DEVIL STATION

The West Jersey Radio Amateurs (WJRA) will mount a second operation from the South Jersey Pine Barrens, the haunt of the feared Jersey Devil. Beginning and ending at midnight, the courageous WJRA group will attempt again this year to operate the entire 24 hours of Halloween, October 31st. A unique, handsome certificate engraved with a countenance of the Jersey Devil will be sent to all stations worked who send an SASE to WJRA, PO Box 62, Burlington NJ 08016. Frequencies to be used are 15 kHz from the bottom of each General phone band, 80 through 2 meters, and 146.55 FM. Novice operation will also be 15 kHz up.

The Jersey Devil was born in 1735, a 13th child, in the Pine Barrens of Burlington County at a place called Leeds Point. Not long after its birth, on a foggy and dreary night so usual in the Pine Barrens, the child assumed a serpent-like body, cloven hoofs, the head of a horse, wings of a bat, and the forked tail of a dragon. With loud raucous cries, it flew up the chimney and into the heart of the Pinelands. Appearances and sightings occur even today. On Halloween, the WJRA will maintain a radio vigil, trying once again to capture a glimpse of the Devil. Will they see him? Give them a call—W2JUG—and get a first-hand report.

73 MAGAZINE AWARDS PROGRAM

WORK THE WORLD

97 WD6DFN	126 WB7UCU
98 KN4F	127 KA3FUU
99 WA2WRD	128 WD4JEQ
100 N8BDI	129 W7GLU
101 WB9NOV	130 VK2PY
102 KA3DBN	131 VK3DXY
103 K9GHP	132 KB2WH
104 WØYBV	133 I1WXY
105 KA7GIN	134 K3WUR
106 W8HTM	135 KA1RC
107 N6ATS	136 PY2CAR
108 KC5TK	137 I1EEW
109 K3STM	138 KØLST
110 9G1RT	139 HI3LRB
111 WA2LYF	140 ZL1SZ
112 ZS6ABA	141 ZS8XS
113 VK2HD	142 ZS6XK
114 VE3LVN	143 PY2FK
115 VE1ACK	144 JF1CPH
116 PY2BTR	145 W1SIX
117 VE3JPJ	146 PAØTP
118 HC2RG	147 JJ1KTI
119 WA9IVU	148 W3BHM
120 VK2NHV	149 JA5MG
121 KH8KU	150 JF1SEK
122 N5CSW	151 KAØMMD
123 WN5MBS	152 8P8OV
124 AK1H	153 KC8AU
125 VK3BMA	

NORTH AMERICAN AWARD

213 N5CSW	230 VE7DRI
214 KH6KU	231 I1EEW
215 K9RNR	232 W3BHM
216 VE1YX	233 PY2CAR
217 WN5MBS	234 KA2IAL
218 VK3BMA	235 KA1RC
219 WB7UCU	236 KAØMMD
220 4Z4VG	237 WD5IBM
221 PY1BVY	238 WB2VTD
222 OE1-111080	239 N4CXK
223 W7GLU	240 N7CZH
224 I1WXY	241 N5AUB
225 VK3DXY	242 KA2JJK
226 4W-16260	243 HI3AMF
227 VK2PY	244 PY2FK
228 OE2ABM	245 K2YOF
229 KØLST	246 PY2RHL
247 K9LJP	258 JF1CPH
248 HI3LRB	259 JJ1KTI
249 W9CC	260 VE6CNV
250 ZL1SZ	261 I5HOR
251 KA9CEJ	262 PY2RAN
252 ZS6XS	263 KA5FLE
253 ZS6XK	264 PY1DWM
254 PAØTP	265 JF1SEK
255 PAØIEM	266 JA5MG
256 W9CC	267 KC8AU
257 PY1EWN	268 N6GBM

SOUTH AMERICAN AWARD

186 N5CSW	211 PY2FK
187 KH6KU	212 K9LJP
188 K9RNR	213 HI3LRB
189 WN5MBS	214 WD9AQC
190 DA1AS	215 ZL1SZ
191 VK3BMA	216 KA9CEJ
192 WB7UCU	217 ZS6XS
193 4Z4VG	218 ZS6XK
194 PY1BVY	221 W9CC
195 WA9AHZ	222 KAØMMD
196 W7GLU	223 JF1CPH
197 W8UMP	224 W1SIX
198 VK2PY	225 PY2IEM
199 VK3DXY	226 PAØTP
200 I1WXY	227 JJ1KTI
201 N5AUB	228 ZL2LQ
202 N7CZH	229 KA2JJK
203 N4CXK	230 8P6OV
204 AI1Y	231 JF1SEK
205 KA1RC	232 JA5MG
206 PY2CAR	233 KC8AU
207 W3BHM	234 N5ACU
208 I1EEW	235 VE6CNV
209 KØLST	236 N6GBM
210 HI3AMF	

ASIAN AWARD

142 N5CSW	163 PY2FK
143 KH6KU	164 N4AKO
144 W7GLU	165 HI3LRB
145 WD4JEO	166 ZL1SZ
146 WB7UCU	167 ZS6XS
147 VK3BMA	168 ZS8XK
148 DA1AS	169 PAØTP
149 AK1H	170 JF1CPH
150 W1SIX	171 JR7ICN
151 WN5MBS	172 PY2IEM
152 I1WXY	173 JJ1KTI
153 KB2WH	174 JA5PWW
154 8P6OV	175 OZ5EDR
155 VK3DXY	176 W3BHM
156 HZ-16260	177 JH3OHO
157 4W-16260	178 HI3AMF
158 VK2PY	179 JA3UCO
159 PY2CAR	180 KAØMMD
160 KA1RC	181 JF1SEK
161 I1EEW	182 JA5MG
162 KØLST	183 KC8AU

AFRICAN AWARD

160 N5CSW	168 W7GLU
161 KH6KU	169 JA5PWW
162 K9RNR	170 VK2PY
163 WN5MBS	171 HZ-16260
164 DA1AS	172 4W-16260
165 VK3MBA	173 VK3DXY
166 WB7UCU	174 I1WXY
167 4Z4VG	175 KØLST
176 I1EEW	192 WA1UDH
177 W3BHM	193 KA2JJK
178 AL7O	194 JR3LVI
179 PY2CAR	195 JF1CPH
180 PY1DWM	196 KAØMMD
181 N4CXK	197 PAØTP
182 TU2HJ	198 JJ1KTI
183 KA1RC	199 PY1BVY
184 JH7OFH	200 HI3AMF
185 PY2FK	201 PY2RAN
186 HI3LRB	202 JH3OHO
187 ZL1SZ	203 JF1SEK
188 W8UMP	204 JA5MG
189 ZS6XS	205 KC8AU
190 ZS6XK	206 N5AUB
191 PY2IEM	207 4X4OQ

EUROPEAN AWARD

251 WD8MAI	282 N7CZH
252 W7GLU	283 N5AUB
253 OE3SWL-DWZ	284 TU2HJ
254 OE1-111080	285 HI3AMF
255 DF5VO	286 PY2FK
256 WB7UCU	287 KA5BQM
257 VK3BMA	288 K2YOF
258 WN5BMS	289 JA9AXS/1
259 VE1YX	290 PY2SZK
260 K9RNR	291 K9LJP
261 KH6KU	292 HI3LRB
262 N5CSW	293 WD9AQC
263 KH6F	294 ZS1SZ
264 I1WXY	295 ZL2LQ
265 VK3DXY	296 KA9CEJ
266 KA7CPZ	297 ZS6XS
267 HZ-16260	298 ZS6XK
268 4W-16260	299 PAØTP
269 VK2PY	300 PY2IEM
270 OE2ABM	301 WA2FYW
271 KØLST	302 JR7ICN
272 VE7DRI	303 JF1CPH
(14 MHz)	304 WP4ATF
273 VE7DRI	305 JJ1KTI
(21 MHz)	306 VE6CNV
274 I1EEW	307 JA5PWW
275 W3BHM	308 JH3OHO
276 PY2CAR	309 JY9CW
277 KA2IAL	310 JF1SEK
278 KA1RC	311 JA5MG
279 KAØMMD	312 N6GBM
280 WB2VTD	313 KC8AU
281 N4CXK	

OCEANIA AWARD

145 N5CSW	183 PY2CAR
146 KH6KU	164 I1EEW
147 WN5MBS	165 KØLST
148 JA9AXS/1	166 JG1QLT
149 VK3MBA	167 PY2FK
150 WB7UCU	168 OZ-DR-1239
151 KA3FUU	169 N4AKO
152 W7GLU	170 HI3LRB
153 K3WUR	171 ZL1SZ
154 VK2PY	172 ZS6XS
155 VK3DXY	173 ZS6XK
156 KB2WH	174 JF1CPH
157 I1WXY	175 JR3LVI
158 N7CZH	176 JR7ICN
159 N4CXK	177 PAØTP
160 W1SIX	178 JA5PWW
161 K3WUR	179 JJ1KTI
162 KA1RC	180 W3BHM

OCEANIA (Cont.)

181 VE6CNV
182 JH3OHO
183 JA3UCO
184 KAØMMD
185 JF1SEK
186 JA5MG
187 KC8AU
188 N5AUB
189 N6GBM

73 DX COUNTRY CLUB AWARD (SSB)

75 WD6DFN
76 8P6OV
77 KN4F (1979)
78 KN4F (1980)
79 WA9IVU
80 W7HAZ
81 K9IML
82 AG7P
83 KA1UA
84 N6ATS
85 KE7C
86 KA3FUU
87 VK2HD (1979)
88 VK2HD (1980)
89 VK2HD (1981)
90 9G1RT
91 SV1GJ
92 WA8KMK
93 VK2NHV
94 CT2CQ
95 HC2RG
96 NR4S
97 VK3BMA
98 WD4JEQ
99 KC4YY
100 N5CSW
101 4W-16260
102 VK2PY
103 N2CFN
104 W1SIX
105 N4CXK
106 ZS6XS
107 VE3JPJ
108 I2ODZ
109 I5HOR
110 KA1RR
111 WB3HTK
112 KI2G
113 DEØDXM (1979)
114 DEØDXM (1980)
115 DEØDXM (1981)
116 KA6D
117 DJ9ZB

73 DX COUNTRY CLUB (CW) AWARD

13 VE1ACK
14 KC3W
15 KØLST
16 OE2ABM
17 K6FO
18 4X4FU
19 PY2FK
20 PY2BTR
21 DF5UT

73 DX COUNTRY CLUB (MIXED) AWARD

22 WB5LBR
23 WD6EEQ
24 NL7J
25 KAØMMD

DX CAPITALS OF THE WORLD AWARD

18 N6ATS
19 VK2HD
20 ZS6ABA
21 SV1GJ
22 VE1ACK
23 4Z4VG
24 VK2PY
25 WB3BVL
26 WB2TOJ
27 PY2FK
28 VE6CNV

10-METER DX DECADE AWARD

1 WB4WRE/M
2 AC3Q
3 W5TJQ
4 WDØAVG
5 DA2AL
6 WB4TZA
7 WD5JRG
8 WA4ZLZ
9 WB8LSV
10 WB9WFZ
11 W8AKS/6
12 KA3FUU

SPECIALTY COMMUNICATIONS AWARD CLASS A: WORKED ALL STATES

1 WA6VGS
2 KE7C

SPECIALTY COMMUNICATIONS AWARD CLASS A-1: DX COUNTRIES

9 K3WUR (RTTY)
10 WB2VTD (RTTY)
11 PY3CJS (RTTY)
12 KE7C (RTTY)
13 AL7O (RTTY)
14 PY1EWN (RTTY)
15 OE1PBA (RTTY)
16 N5CSW (RTTY)
17 HB9MQM (OSCAR 7/8)
18 OE4HQ (RTTY)
19 VE2QO (RTTY)
20 VE2QO (OSCAR 7/8)
21 ON4CM (RTTY)

Q-5 AWARD OF EXCELLENCE

61 N7CPE
62 N8BDI
63 KA7EII
64 W8UPD
65 KA2IDJ
66 WB9KUV
67 KA5KKZ
68 KA9ENM
69 PY2UGS
70 KA3FUR
71 KA6JQB
72 KA7CPZ
73 KA1DJB
74 KA3GSN
75 WB9HPR
76 W4PCK
77 KA4LSJ (28 MHz)
78 KA4LSJ (21 MHz)
79 KA3FUU
80 N1BDB
81 KP4FCK
82 KA2MIM
83 W1DWA
84 KA2JMJ
85 KA7JNP
86 WA2AKX
87 KP4ERH
88 KA8CUS
89 KA4VNS
90 N8CJF
91 WDØEPV
92 KB8WJ
93 KAØJTT
94 KA5KOS
95 VK2VVA
96 KA4WBR
97 KA8MVV
98 KA1HJK
99 KA9JJK
100 KA2IAL
101 WL7AHD
102 PY2SZK
103 KAØMMD
104 KA1HFN
105 KA9CEG
106 KA9CEJ
107 KA9LYH
108 N8CYS
109 WB9UIA
110 NS4J
111 VE6CNV
112 KA2LHO

CENTURY CITIES AWARD

23 KC9CA
24 N8CJF
25 KE7C
26 AKØG
27 WB7VBQ
28 KA8MVV
29 KA3FUU
30 OE8MOK
31 8P6OV
32 KAØMMD
33 WA6NIE
34 VE3JPJ
35 KA9BJX
36 KA1HJK
37 NP4DZ
38 VE6CNV

DISTRICT ENDURANCE AWARD

8 XE1TIS (49 min.)
9 KØWNY (52 min.)
10 KE7C (14 min.)
11 KA3FUU (50 min.)
12 SV1GJ (42 min.)
13 OK2QX (56 min.)
14 KAØMMD (39 min.)

WORKED ALL USA AWARD (80 METERS)

7 WAØRVK
8 N4QH
9 W4PCK
10 WB2ZEL

WORKED ALL USA AWARD (40 METERS)

4 WDØBOS
5 N5AHZ
6 N4QH
7 KA1DNB

WORKED ALL USA AWARD (20 METERS)

11 KA9JOL
12 KE7C
13 KC4YY
14 WAØCEL
15 KA4OOU
16 KA9LYH

WORKED ALL USA AWARD (15 METERS)

5 KA4IFF
6 WB9UKS
7 N4QH
8 WB7VQB

WORKED ALL USA AWARD (10 METERS)

5 VK7NBT
6 VE1BWP
7 N4QH
8 N5CSW

WORKED ALL USA AWARD (6 METERS)

8 N5DDB
9 N9CEX
10 K4GOK
11 W4CKD

WORKED ALL USA AWARD (MIXED BAND)

54 N7CPE
55 KA3GSN
56 KA3FUU
57 KA4VNS
58 AG7P
59 N8CJF
60 KA5EEZ
61 KA7JNP
62 WA9IVU
63 8P6OV
64 KA7CPZ
65 AKØG
66 VE3JPJ
67 HC2RG
68 KAØJTT
69 KA2MIM
70 KA8MVV
71 N3CHN
72 N3AKQ
73 KA1HJK
74 KAØMMD
75 WB9UIA (1980)
76 WB9UIA (1981)
77 WB9UIA (1982)
78 VE6CNV

SATELLITES

Net Name	Day	Time	Freq. (MHz)
East Coast	Wed	2100 Eastern	3.850
Mid-America	Wed	2100 Central	3.850
West Coast	Wed	2000 Pacific	3.850
New York City	Wed	2200 Eastern	144.400
Goddard Center	Wed	2100 Eastern	146.835
Los Angeles	Wed	2000 Pacific	145.805
UK	Sun	1000 UTC	3.780
International	Sun	1800 UTC	21.280
International	Sun	1900 UTC	14.282
European	Sat	1000 UTC	14.280
Espanol	Sun	1900 UTC	14.180
Asia/Pacific	Sun	1100 UTC	14.305
South Pacific	Sat	2200 UTC	28.878
South Africa	Sun	0900 UTC	14.280
SEASAT	Sun	1300 UTC	7.280
Australian	Sun	1000 UTC	3.680
New Zealand	Wed	0800 UTC	3.850

Table 1. AMSAT nets provide up-to-the-minute news about amateur satellite developments.

AMSAT NETS

Keeping up with the latest developments in the amateur space program is as easy as tuning your ham rig to one of the AMSAT nets. During these sessions, you'll hear information ranging from the latest Phase III news to tips on when and where to work the rare satellite DX. Technical discussions abound, and you can usually pick up the latest tracking data. Table 1 is a list of these informative gatherings.

PHASE IIIB PROGRESS

Summer was a time of further testing and refinement for the Phase IIIB satellite, now tentatively scheduled for January, 1983,

Amateur Satellite Reference Orbits

Date	OSCAR 8 UTC	OSCAR 8 EQX	RS-5 UTC	RS-5 EQX	RS-6 UTC	RS-6 EQX	RS-7 UTC	RS-7 EQX	RS-8 UTC	RS-8 EQX	Date
Nov 1	0013	79	0008	296	0157	326	0101	311	0133	317	1
2	0017	80	0002	296	0141	324	0051	310	0131	318	2
3	0022	81	0157	326	0126	322	0042	309	0128	319	3
4	0026	82	0151	327	0110	319	0032	308	0125	320	4
5	0030	84	0146	327	0055	317	0022	307	0122	320	5
6	0035	85	0141	327	0040	315	0013	306	0119	321	6
7	0039	86	0135	327	0024	312	0003	305	0116	322	7
8	0043	87	0130	327	0009	310	0153	334	0114	323	8
9	0048	88	0125	327	0152	337	0143	333	0111	324	9
10	0052	89	0119	328	0137	335	0133	332	0108	324	10
11	0057	91	0114	328	0121	333	0124	332	0105	325	11
12	0101	92	0109	328	0106	330	0114	331	0102	326	12
13	0105	93	0103	328	0050	328	0104	330	0059	327	13
14	0110	94	0058	328	0035	326	0055	329	0057	328	14
15	0114	95	0053	329	0020	323	0045	328	0054	329	15
16	0119	96	0047	329	0004	321	0035	327	0051	329	16
17	0123	98	0042	329	0148	349	0026	326	0048	330	17
18	0127	99	0037	329	0132	346	0016	325	0045	331	18
19	0132	100	0031	329	0117	344	0006	324	0043	332	19
20	0136	101	0026	329	0101	342	0156	354	0040	333	20
21	0141	102	0020	330	0046	339	0146	353	0037	333	21
22	0002	78	0015	330	0031	337	0137	352	0034	334	22
23	0006	79	0010	330	0015	335	0127	351	0031	335	23
24	0011	80	0004	330	0000	332	0117	350	0028	336	24
25	0015	81	0159	0	0143	360	0108	349	0026	337	25
26	0019	82	0153	1	0128	357	0058	348	0023	338	26
27	0024	83	0148	1	0112	355	0048	347	0020	338	27
28	0028	84	0143	1	0057	353	0039	346	0017	339	28
29	0033	86	0137	1	0041	350	0029	346	0014	340	29
30	0037	87	0132	1	0026	348	0020	345	0011	341	30
Dec 1	0041	88	0127	2	0011	346	0010	344	0009	342	1
2	0046	89	0121	2	0154	13	0000	343	0006	342	2
3	0050	90	0116	2	0139	11	0150	12	0003	343	3
4	0055	91	0111	2	0123	9	0140	11	0000	344	4
5	0059	93	0105	2	0108	6	0130	10	0157	15	5
6	0103	94	0100	2	0052	4	0121	9	0154	16	6
7	0108	95	0055	3	0037	2	0111	8	0151	17	7
8	0112	96	0049	3	0022	359	0102	7	0149	17	8
9	0117	97	0044	3	0006	357	0052	7	0146	18	9
10	0121	98	0038	3	0149	24	0042	6	0143	19	10
11	0125	100	0033	3	0134	22	0033	5	0140	20	11
12	0130	101	0028	4	0119	20	0023	4	0137	21	12
13	0134	102	0022	4	0103	17	0013	3	0134	21	13
14	0139	103	0017	4	0048	15	0004	2	0132	22	14
15	0000	78	0012	4	0032	13	0153	31	0129	23	15

launch. According to the *AMSAT Satellite Report*, malfunctions which occurred in both communications transponders during a midsummer thermal/vacuum test were quickly corrected by the AMSAT DL crew in Germany.

If all goes as planned, Phase IIIB will fly aboard the seventh launch (L7) of the European Space Agency (ESA) Ariane missile. The January launch date depends to a large extent on the successful launches of L5 and L6. The former was scheduled for early September and the latter for late November.

ESA's Ariane is now a head-on competitor with the Space Shuttle as a commercial satellite launcher. By means of low prices, advertisements in satellite industry magazines, and other marketing tools, ESA has built a backlog of more than 20 spacecraft awaiting a boost into orbit.

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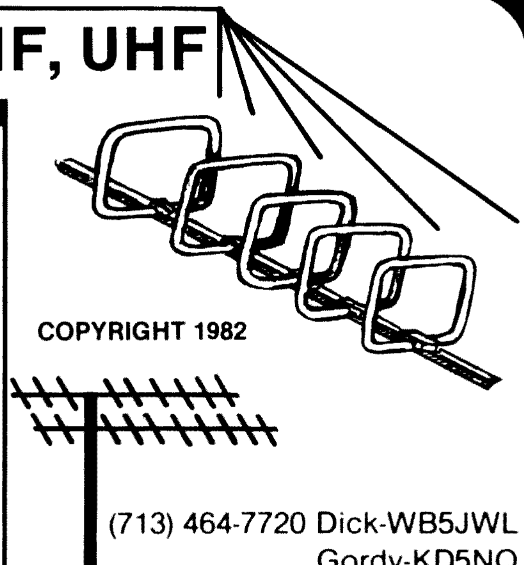

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**First Place Winner at Baton Rouge Gain Measuring Contest (7/31/82).

***Second Place Winner at Baton Rouge Gain Measuring Contest (7/31/82).

JWL ELECTRONICS
9138 Western Drive
Houston, TX 77080

NEW PRODUCTS

GaAsFET VHF/UHF AMPLIFIERS

Lunar has announced a line of narrowband tuned receiving preamplifiers for the VHF and UHF communities. Typical specifications exceed those of previously-available receiving preamplifiers by up to ten times in performance. Exhibiting very high gain at VHF (typically 22–24 dB), moderate gain at UHF (typ. 16 dB), and a very low noise figure (typ. 0.3–0.4 dB on VHF and 0.5–0.6 dB on UHF land-mobile frequencies), these units are also well-suited to high-rf environments, exhibiting 1-dB compression power levels of + 10 dBm or more.

The good gain, coupled with the very low noise figure, effectively reduces a typical repeater receiver sensitivity to that of ambient limitations. 6–10-dB improvements in receiver performance have been consistently reported by users in a typical repeater installation between the duplexer and receiver input.

Units are built to the customer's specified frequency, but do exhibit a typical bandwidth of 5% CF with little degradation in performance. Dc input is well-filtered and regulated, which allows accepting any dc voltage between 12 and 28 V (drain approx. 35 mA). VHF connector options include BNC, SMA, N in and out; UHF connector options are SMA, N in and out, with SMA in BNC out the standard option. SMA to RG-58 connectors are included as options for UHF units. Frequencies are available from as low as 15 MHz to as high as the 800-MHz land-mobile bands.

For further information, contact *Lunar Electronics, 2775 Kurtz Street, Suite 11, San Diego CA 92110.* Reader Service number 484.

NEW FROM W-S ENGINEERING

W-S Engineering, manufacturers of the Porta-Peater, have announced the introduction of new related products that will be of interest to both Porta-Peater owners and other amateurs alike.

In addition to the Porta-Peater M-100, which will interface with any two transceivers or receiver and transmitter pairs to create a full-function repeater, W-S Engineering now offers its new Porta-Link PL-250 and MB-1 Multi-Board building block.

The Porta-Link PL-250 is a single-board simplex link and portable repeater that may be interfaced with two transceivers, or two receiver-transmitter pairs, to form a complete repeater system for applications that do not require a CW-ID system. Owners of the Porta-Peater can add the Porta-Link board and have a complete duplex link, remote base, and dual repeater. The PL-250 has on-board controls for timeout duration, hang time, audio balance, local mike gain, and local speaker amplifier gain. Connections to the PL-250 are done via a 22-pin, 0.156-inch edge connector.

The MB-1 Multi-Board building block is a "universal" circuit that can provide up to *ten* different functions. Configured by the user, the MB-1 can be a variable audio-frequency signal generator, variable radio-frequency signal generator, audible CMOS logic probe, LED output logic probe, repeater beeper, gated monostable, gated astable, pulse stretcher, adjustable timer, individual positive and negative edge triggers, and more.

The MB-1 is completely self-contained and operates on any dc voltage between 5 and 15 volts. Output level, pulse length, and frequency are fully adjustable with on-board controls. The MB-1 comes complete with an assembly and applications manual, and all parts, sockets, PC board, and accessories are furnished.

For further information about these products, contact *W-S Engineering, PO Box 58, Pine Hill NJ 08021.* Reader Service number 481.

YAESU FT-102

Yaesu Electronics Corporation has announced the availability of its new FT-102 line of HF equipment.

The FT-102 transceiver utilizes an all-new transmitter section featuring three 6146B final tubes for extremely low distortion. In addition to VOX and an rf clipping-type speech processor, the FT-102 transmit audio may be adjusted for optimum response to the operator's voice.

The FT-102 receiver uses husky JFET components in the front end for wide dynamic range. A number of filter options are available, with wide/narrow filter selection independent of the mode switch. Audio peak filtering for CW, audio shaping for all modes, and an i-f notch filter provide outstanding intelligence recovery. The noise blanker is highly effective against the "woodpecker" and pulse noises.

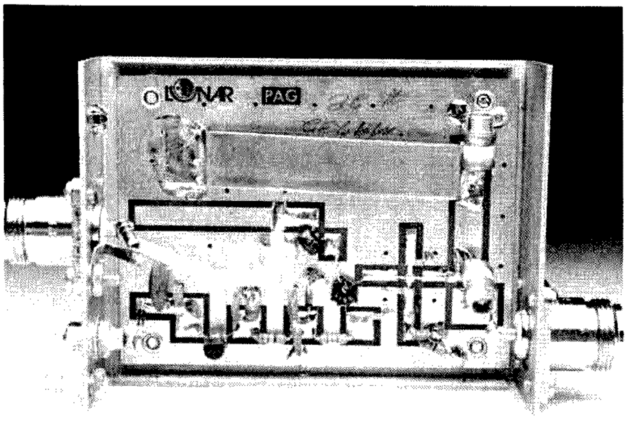
Equipped for SSB and CW operation, the FT-102 option list includes an AM/FM module for activating those modes. Other accessories for the FT-102 are the FV-102DM synthesized vfo, the SP-102 speaker with audio filter, the SP-102P speaker/patch, and the FC-102 1.2-kW antenna tuner with optional remote antenna selector.

For further information, contact *Yaesu Electronics Corp., PO Box 49, Paramount CA 90723.* Reader Service number 476.

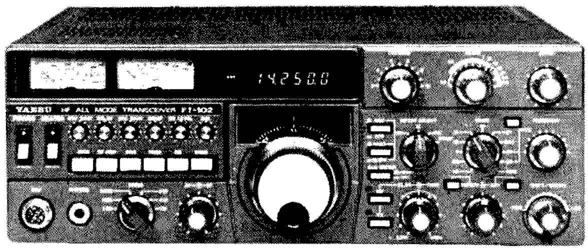
DENTRON'S NEW 5-BAND TRANSCEIVER

DenTron Radio Company has begun production on a new 200-Watt, CW, SSB solid-state transceiver named the Horizon One, which covers 80-15 meters and any 500-kHz segment of 10 meters. Its sensitivity is .35 uV for 10-dB signal-to-noise ratio, with selectivity of 2.4 kHz at 6-dB points and G-60-dB factor of 1.7:1. Performing with the latest MOSFET and ballasted emitter semiconductors, the Horizon One also has a pinpoint digital frequency readout using LSI technology.

Input power is 200 W PEP with an output of 100 W PEP nominal and 80 W PEP on 10 meters. Power requirements are 12.6–14.5 V dc regulated at 2.0 Amps maximum and 12.6–14.0 V dc regulated or unregulated at 18 Amps peak. The Horizon One has a built-in VOX, noise blanker, and hand mike as standard

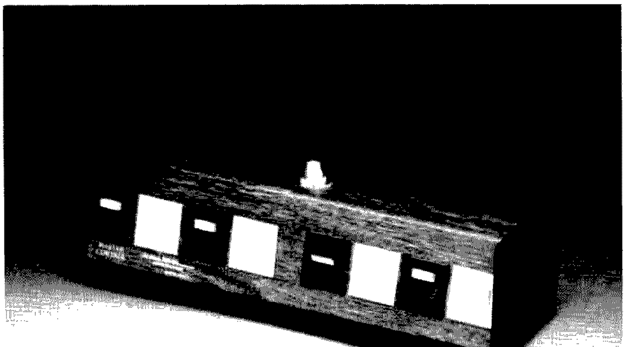


Lunar's GaAsFET VHF/UHF amplifier.



Yaesu's FT-102.

DenTron's Horizon One.



Alpha Delta's Master Control Console.

equipment. Optional accessories include an ac power supply, matching antenna tuner, linear amplifier, and mobile mount.

For further information, contact Tim Neill, Technical Sales Representative, *DenTron Radio Company, Inc., 1605 Commerce Drive, Stow OH 44224; (216)-688-4973.* Reader Service number 485.

DIVERSITY RECEPTION FOR REPEATERS

Pegasus Electronics has announced a new diversity receiving system for repeaters. Now you can turn any repeater into a "super repeater" by adding a VS-2 voting system and an rf link. The VS-2 compares the audio quality of any 2 receivers (they need not be matched) and connects the one that hears you best to the repeater for retransmission. Since the VS-2 is always listening to both receivers, it can continuously update as you go from a peak on one to a null on the other. The result: You have a repeater which sounds like it has no "dead" spots and your users are always readable as long as they are solid Into any *one* of your receivers.

The VS-2 was designed to work with anything. It has all its own level controls and ensures a constant output to your repeater. It was designed to be installed by anyone who knows how to read a scope. The VS-2 is supplied on a single circuit board (5⅛" × 5¼") and contains two squelch circuits (COS). It is fully compatible with 12-volt logic, 5-volt logic, and inverted logic by cutting the desired jumpers (or you can use your own logic and bypass that portion of the VS-2). The VS-2 is not a kit—it comes fully assembled and tested and is warranteed for one full year.

For further information, contact *Pegasus Electronics, Inc., 88 New Dorp Plaza, Staten Island NY 10306.* Reader Service number 488.

PHOTOVOLTAIC SYSTEMS

Encon Corporation, authorized distributors of Solarex photovoltaic products, has a publication entitled *The Complete Photovoltaic Systems Catalog* which can answer many of your questions about solar energy conversion and distribution. The catalog covers an introduction to photovoltaic systems, photovoltaic cells and panels, renewable energy batteries, charge controllers and metering devices, ac power inverters, how to select a workable system for your needs, basic 12-volt systems, large-dc/small-ac systems, components and accessories you will need, solar demonstrators, educational materials, marine and recreational panels, and much more.

If you have an interest in direct conversion of sunlight to power, you will enjoy this catalog and overview of the entire subject. A price guide as well as an applications questionnaire form are included so that you can obtain expert advice and assistance for potential applications that you may have in mind. Encon will assist you with your questions and needs in solar applications.

For further information, contact *Encon Corporation, 27584 Schoolcraft, Livonia MI 48150.* Reader Service number 479.

MASTER CONTROL CONSOLE

Alpha Delta Communications has just announced its new Master Ac Control Console which combines power-surge protection and centralized "on/off" control of several components. The MACC unit plugs into a single outlet and provides eight plug-in "U" ground outlets: one "hot" outlet for continuously-powered appliances such as a clock, for example, and seven outlets for individually-controllable components.

The front panel has rocker switches for the individually-controllable components, plus a master control "on/off" rocker which allows the entire system to be turned on or off at once. All rockers are lighted when "on."

The surge-protection feature is perhaps the most important feature of Alpha Delta's MACC unit. The delicate circuitry of modern solid-state electronic equipment is particularly vulnerable to damage from power surges and spikes which can be caused by natural or man-made sources such as lightning strikes, electric motors, transformers, wind-blown snow, clouds, fluorescent lamps, power outages, and the like. The MACC is tested to IEEE pulse standards and is rated at 15 A, 125 V ac, 60 Hz, 1875 Watts continuous-duty total for the console.

Priced at $79.95 (US), the MACC is available from Alpha Delta dealers or, for $4 more to cover postage and handling, direct from the factory. Alpha Delta will quote on overseas postage and on the "European Model" MACC-E available with VDE-approved socket for 240 V ac.

For further information, contact *Alpha Delta Communications, PO Box 571, Centerville OH 45459.* Reader Service number 486.

MORTTY SOFTWARE FOR COMMUNICATIONS

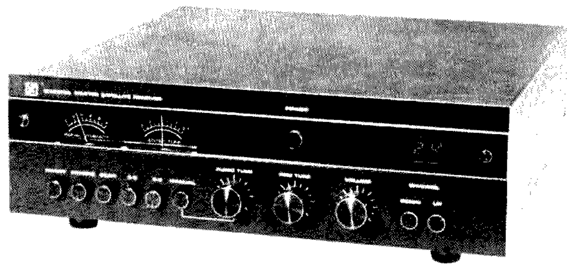
MORTTY is a general-purpose communications program adaptable to almost any set of conventions in current use. It includes ASCII and Baudot capabilities at a wide range of baud rates. There are 18 parameters for adaptation to particular conventions such as full screen, split screen, full or half duplex, and many more. There are 15 disk operations, including disk file send, receive, direct binary to hex upload, hex to binary download, automatic message capture with file sequencing, and automatic answering of messages from a disk file.

The equipment required to make use of the program is an H89 or Z89 microcomputer with 32K of memory and an H88-3 serial interface. MORTTY reprograms the serial interface for baud rate, etc., according to the communications mode selected, and does the translation between ASCII and Baudot when a Baudot mode is in use. In place of the H89 or Z89 with H88-3, you may use an H8 with H19 terminal and H8-4 serial interface with H17 disk system.

The software required is HDOS v. 2.0, which is the current Heath disk operating system. Heath claims that programs should be upward-compatible with new HDOS releases, but we cannot guarantee that this will always be true.

The price of the MORTTY pro-

MFJ's VHF converter.



Channel Master's model 6128 satellite receiver.

gram is $100.00 ppd in the USA. Ohio purchasers should add 6% sales tax. Foreign prices will depend on the additional expenses of mailing. This price buys a printed copy of a thorough user's guide of about 60 pages and a 5¼" hard-sector disk with the absolute binary MORTTY program.

For further information, write *"MORTTY program"* or *"Phillip L. Emerson" at 3707 Blanche, Cleveland Heights OH 44118.* Reader Service number 480.

MFJ-313 POLICE/FIRE/ WEATHER BAND CONVERTER FOR 2-METER HAND-HELDS

MFJ has introduced its new compact VHF police/fire/weather band converter for 2-meter hand-helds.

It turns your synthesized 144-148-MHz hand-held into a police/fire receiver (154-158 MHz) and gives you direct frequency readout on your hand-held. A programmable scanning hand-held becomes a sensitive programmable police/fire scanner.

You can also receive weather, maritime coastal, and more on the 160-164-MHz band. Feed-through allows simultaneous scanning of both 2 meters and the 160-164-MHz band.

A high-pass input filter and a 2.5-GHz transistor give very high uniform sensitivity over both the 154-158-MHz and 160-164-MHz bands. Each band is crystal-controlled for excellent stability.

A Bypass/Off position allows transmitting through the converter. It is protected against burnout if you transmit (up to 5 Watts) with the converter on. Short direct-signal paths give low insertion swr.

This compact converter measures only 2¼ × 1½ × 1½ inches and weighs 4 ounces. A single AAA battery (not included) gives you months of operation. The cabinet is black and is made of rugged, lightweight aluminum for years of hard use. BNC connectors mount the converter directly between your handie-talkie and antenna without cables.

For further information, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 483.

NEW FROM VOCOM

VoCom Products Corporation has announced two new products for the amateur 220-MHz band: a "two Watts in, twenty Watts out" power amplifier with a suggested list price of $84.95 and a "Power Pocket" for the Icom IC-3AT hand-held transceiver with a suggested list price of $229.95.

With the Power Pocket, the 220-MHz operator now has the same advantage that he had on two meters: the convenience of a hand-held and the punch of a mobile rig. Styled essentially the same as the two-meter version, the 220-MHz Power Pocket offers a large speaker, an audio amplifier, an rf power amplifier, and a battery charger that meets the current requirements of the radio. For example, you can use the amplified hand-held in your car on the way to work, hold your own in any QSO, and arrive with a battery that is still charged...as good or better than it was when you started!

For further information, contact *VoCom Products Corporation, 65 East Palatine Road, Prospect Heights IL 60070.* Reader Service number 478.

EARTH-STATION RECEIVER

Channel Master has just introduced a new Earth-station receiver, the model 6128, offering a wide range of features and advanced electronics. The receiver is a 24-channel synthesized unit employing a single downconverter installed at the dish and a receiver unit located in the home.

For simplified tuning, the full 24-channel number format is displayed on the receiver's LED digital channel display. Channels are power-selected by Up/Down push-buttons and fine tuning is provided with the assistance of the Center/Fine Tune meter.

Two Priority Audio buttons select audio channels (6.8 and 6.2 MHz), while additional audio channels may be selected manually.

A signal-strength meter shows the relative strength of received signals. The Channel Scan button is depressed to cycle the receiver through the complete horizontal channel range in about one second, as an aid to aiming the antenna.

Automatic polarity switching allows one-button selection of any channel without additional polarity adjustments, and a built-in modulator eliminates the need for a separate modulator. The model 6128 is capable of receiving normal or inverted video signals. An optional model 6192 remote control unit offers the added convenience of remote channel selection and fine tuning.

For further information, contact *Channel Master, Division of Avnet, Inc., Ellenville NY 12428.* Reader Service number 482.

NEW TS-830, TS-930, R-820 FILTER KIT

Fox Tango Corporation has announced the availability of a special high-quality matched-filter kit designed to significantly improve the selectivity of the popular Kenwood R-820, TS-830, and new TS-930 series. These rigs all use similar dual-conversion i-f systems with 8830-kHz first and 455-kHz second intermediate frequencies. I-f bandwidth filtering at both frequencies is used to provide VBT (variable bandwidth tuning). However, in the TS-830S model, the 2.7-kHz bandwidth of both original filters (resulting in a net bandwidth of 2.4 kHz with VBT off), the combined filter shape

factors (1.34 with VBT off), and a combined ultimate rejection of about 80 dB leave much to be desired.

Under the same conditions, the Fox Tango filters (both 8-pole discrete crystal units instead of the original monolithic and ceramic types) each have a bandwidth of 2.1 kHz (net bandwidth of 1.99 kHz), a combined shape factor of 1.19 (the lower, the better), and an ultimate rejection greater than 110 dB (the higher, the better). The effects are even more pronounced when VBT is used to narrow the operating i-f bandwidth to reduce QRM.

The matched-pair filter kit, complete with detailed instructions, two 2.1-kHz Fox Tango filters (guaranteed for one year), and all needed cables and parts, is being offered at an introductory price of $150 plus $3 for shipping ($5 for air).

For further information, contact *Fox Tango Corporation, PO Box 15944, W. Palm Beach FL 33406; (305)-683-9587.* Reader Service number 477.

REVIEW

COM-RAD INDUSTRIES CR1720A "MOBILE EAR" ANTENNAS

Jim Waldron of Com-Rad has been interested in space-saving antennas for a long time, and he has built and tested dozens of them with the idea that a better antenna can be built and is much needed. Jim's idea of a "better" antenna is one that is small, compared with a full-size antenna for the band selected; one that is rugged and has a low profile; one that is easy to tune; and one that is duck soup for mobile operation, yet may be used in portable or fixed operation as well.

At first glance, the Mobile Ears look something like a cross between a giant coil and a short dipole, and that is almost exactly what they are. The large-diameter helix is resonated to frequency by the capacitance-to-ground of the adjustable "resonator"—a capacity hat which is basically two telescoping whip antennas mounted above the coil and parallel with the roof of the automobile. The helix radiates vertically-polarized rf energy in the radial, rather than axial, mode. . . similar to that from a conventional vertical antenna.

The CR1720A comes from the factory with a large magnetic mount that will defy almost any attempt to remove it accidentally from the roof of your car once it has been placed in position. The shunt feed has been factory-preset to provide the proper 50-Ohm feedpoint impedance, and a UHF chassis-type rf connector (SO-238) is located on the center support pillar just above the mounting base. Although it is normally used with the magnetic mount supplied by Com-Rad, the Mobile Ear can be used with any mount that is connected directly to ground, such as groundplane radials or the like. The reason for this is that the coaxial cable is connected to the antenna rather than to the mounting base; for proper operation, the base of the antenna should be grounded. For example, you might wish to replace the magmount with a permanent base for the home station, and this can be done by using the 3/8-24 bolt at the bottom of the antenna—the one that the magmount screws into.

The CR1720A comes completely assembled, except for attachment of the telescoping whips to the top of the support pillar. This is easily and quickly done by sliding the setscrew ends of each whip over the 5/16-inch stubs at the top of the support pillar and tightening the setscrews.

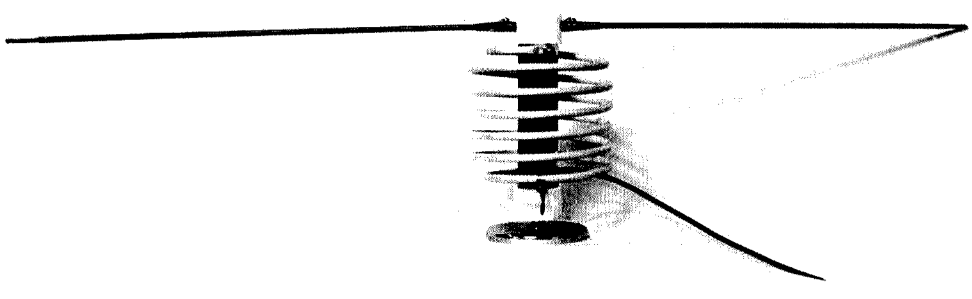
After you have mounted the antenna in the desired location on your car roof, connect an swr bridge in the line between the antenna and your transceiver or transmitter by means of a short length of coaxial cable, placing it as close as practical to the antenna itself (within two or three feet). Set the telescoping whips to approximately 50 inches each, and set your transmitter to the desired operating frequency. Apply a small amount of power and look at the swr. Small incremental adjustments of whip length by sliding the ends in or out (*out*—or longer—to lower the frequency and *in*—or shorter—to raise the frequency) will quickly provide a 1:1 vswr. Observe the lowest possible swr that you can get with your particular vehicle. If it isn't less than about 1.5:1, you can move the clamp ring of the shunt feed in tiny increments to achieve a perfect match. In the case of the test antenna, this wasn't necessary, as a perfect 1:1 match was obtained immediately.

I checked the bandwidth after achieving a perfect match and found that the frequency could be moved 65 kHz in either direction from the resonant frequency without exceeding 2:1 vswr. This means that with most rigs you can operate over your favorite phone or CW segment of the 20-meter band without any retuning at all. Of course, if you are a perfectionist, you can achieve exact matching at any frequency within the band. . . no sweat.

In the case of the test antenna, the inner sections of the whips were fully extended and the outer sections only partly extended. This gives the largest possible diameter at all times. I resonated the antenna at 14.025 MHz and found each whip length to be exactly 53¼ inches, measured from the surface of the support pillar. On the phone portion of twenty meters, I found that 14.3 MHz required a whip length of only 48½ inches. This is likely to vary slightly from car to car because of the different sizes of roof area, etc. A station wagon, for example, will have more groundplane area than a tiny subcompact, but both will work!

No doubt you are anxious to hear about results, and I won't disappoint you. The twenty-meter Mobile Ear really works. After tuning the antenna to resonance and firing up the *73* FT-707 transceiver (with my 1980 Olds Omega parked in my driveway), I found myself in the middle of the WAE contest on Sunday afternoon, August 15th. I answered many calls and received replies from each one. All were 599. Now, I'll admit that this is often the case in a contest, to make things easier for the report giver, but I got an answer to the first call every time! Not only that, but when I called CQ I got answers, too. In the space of only a few minutes I had worked UT5, UQ2, DL7, OZ1, OH5, UK5, G4, N9, KØ, and W4 lands! (Naturally, the US stations don't count, but I wanted to try the antenna.) To date, I've not done much with phone, as I am predominantly a CW operator. However, a few contacts up around 14.300 have been made with good results—G3, for example. . . and others.

I noticed that the noise pickup of the antenna is surprisingly low compared with other verticals I've tried. One possible explanation could be that the com-



Com-Rad's Mobile Ear antenna.

ponents are horizontally-configured and thus less subject to man-made or natural QRN.

I should mention that the CR1720A is beautifully made—the helix is heavy-duty aluminum tubing and the whips are stainless steel. The supporting pillar appears to be heavy-wall PVC and the magmount is chrome-plated steel. Everything considered, the CR1720A is a very fine portable/mobile/fixed antenna, one that the *73* staff really liked. You ought to know that the antenna doesn't need to be removed to put my car in the garage, so yours shouldn't need to be removed either, unless you want to. In public parking facilities, just slide in the whips, remove the coax, take the Mobile Ear off the roof and stow it in the trunk. It takes about 20 seconds . . . and, best of all, it can be remounted and ready to go in about the same time. In my case, I ran the whips fore and aft parallel to the car's centerline so that they wouldn't be sticking out into the side. If you live in an apartment or condo where outside antennas are forbidden, you might find one of the Mobile Ears to your liking.

By the way, the "17" part of 1720 means that this antenna will also work on the 18-MHz (17-meter) band whenever that becomes available to amateurs in the United States. The CR1720A is one of three Mobile Ears which cover 12/15 meters, 17/20 meters, and 30/40 meters: versatile, indeed. The CR1720A lists for $55 plus $4 shipping, direct from the manufacturer.

For further information, contact *Com-Rad Industries, 1635 West River Parkway, Grand Island NY 14072.* Reader Service number 487.

Jim Gray W1XU
***73 Magazine* Staff**

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

a lot, I suspect. It read: C/Q/THE/FASTEIET/GROWING/AMATEUR/RADIO/MAGAZINE/ That's operculiform sending . . . and does not surprise us.

BUNCH GETS BASHED!

The recent Bash debacle in Baltimore should put an end to the fantasy that Bash is doing anyone any good except Bash. I also hope it will shut up a lot of the hams who are moaning about the code and ignoring the fact that Bash has totally done away with any need for technical competence . . . or at least had until the Baltimore epic.

As usual, Bash collected his most generous fees and set about helping a large group of hopefuls to memorize the answers to the FCC exams. He drilled them thoroughly, as always. But this time the FCC had made some very minor changes in the wording of the exam, with the result that 89% of his group flunked. The word is that the changes were small, such as in some of the values in the math problems.

One of the new questions for the General class had to do with the yagi antenna, asking which way it radiated energy. Only *one* of the Bash trainees got this one right! We're dealing with massive ignorance of amateur radio theory, not superficial ignorance, with these memorization sessions and the Bash books.

You know, I've been writing about this problem for quite a long time now and I've had almost zero response from readers. I have yet to hear of one single case where an amateur or a club has protested to a ham dealer carrying the Bash books. Not one case of an irate ham tearing up the books. No protests to *CQ* for carrying the ads for these pernicious books. No, it is obvious that no one really gives a damn whether a newcomer to amateur radio has even the slightest technical knowledge or even the ability to pass a fair test. So why all the fuss about Morse code? Am I talking to a bunch of hypocrites?

The Bash books and the Bash high-priced blitz weekend course are designed for one thing: to help people cheat at the FCC exams and bypass the entry requirements. As long as you don't care if people cheat to get a ham ticket, why should you care whether they are sold by Sears along with a two-meter HT? I don't see any difference, do you? If you really, sincerely, believe that people who cheat to get their ham licenses are suddenly going to be wonderful and productive hams once they get the magic paper from the FCC, then you also believe in the tooth fairy and that Congress will balance the budget. In other words, you're crazy.

Frankly, I'd rather see Sears making all that money instead of Bash; at least we would have more than a tiny dribble of new hams. Bash, despite his heroic efforts, has only been able to bring in a few thousand new hams for us. True, he's probably responsible for much of the few we've had. But if we are going to go along with the Bash system, which you have wholeheartedly accepted, let's go all the way and get some mass merchandisers into the act.

You've seen this thing happening and you haven't done a damned thing about it. Why should I have any respect for you? The hypocrisy over the code just makes this all the more irrational. And don't try to tell me that this is all news to you. Baloney.

NO SECOND LANGUAGES

There has been a liberally-fueled effort to cope with the inrush of Hispanics by allowing them to continue to use Spanish in school rather than force them to learn English. Fortunately, there is now a gathering movement against this policy. We showed that the "melting pot" system worked in America and then we tried to ignore it.

The more we keep newcomers to the United States able to make do without learning English, the more we are taking away from them the benefits which they presumably came here for. I'd like to see our schools teaching foreign languages, but not catering to students who do not have a solid use of English. I'd like to see the publication of foreign-language newspapers and foreign-language radio and television programs discouraged.

The lesson in Canada of how different languages split a country should be heeded. When a group in a country holds on tight to its language and culture, it is a disruptive force. Americans living in other countries tend to stick together and avoid learning the language as much as possible. This hurts both them and the country in which they are living.

The Indians (Asian) have long had a problem with this. In every country where there are a significant number of Indians, they are clannish and generate resentment with the other people. We don't have many Indians in the US, so we are not aware of them, but we do see the Chinese, who have the same problem. For many years we sort of accepted that the Chinese for some reason don't know English and run either laundries or restaurants.

Both the Indians and the Chinese are very hard-working people and, I suspect, if either group had made an effort to integrate into their new countries, they would have virtually taken over. Of course, Americans used to be hard-working people . . . and a few still are . . . but for the most part I see few remnants of this heritage. Perhaps we are most fortunate that the Chinese in America are so clannish and thus are kept from enjoying and benefitting from our educational opportunities.

We still live in a world where hard work pays off. This is one of the reasons we have so few wealthy people. Given equal opportunity, I suspect that the US would be as proportionately populated with wealthy Chinese as it is wealthy Jews. In Taiwan, Hong Kong, and Singapore, we see how well the Chinese can do when they are not held down by Communism. Perhaps we are fortunate, in a way, that the political systems in China have been so destructive. I'm sure that the Chinese could, if working in a free country, run circles around us.

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7A	7	7	7	7	3A	7	7A	14A	21A	21
ARGENTINA	14	14	7	7	7	7A	14A	21A	21A	21A	21A	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14B	14	14	21A	21A
CANAL ZONE	14A	14	7	7	7	7	14A	21A	21A	21A	21A	21
ENGLAND	7	7	7	3A	7	7	14	21A	21A	14	14	7
HAWAII	21	14	7B	7	7	7	7	7B	14	21A	21A	21A
INDIA	7B	7B	7B	7B	7B	7B	14	21	14	7B	7B	7B
JAPAN	14	7B	7B	7B	7B	7	3A	14B	14B	14	14	21
MEXICO	21	14	7	7	7	7	7A	21	21A	21A	21	21
PHILIPPINES	14	14	7B	7B	7B	7B	3A	14B	14	14	14	14A
PUERTO RICO	14	7	7	7	7	7	14	21	21A	21A	21	14A
SOUTH AFRICA	14	7	7	7B	7B	14	21A	21A	21A	21A	21A	14A
U. S. S. R.	7	7	7	7	7	7B	14	21A	21	7B	7B	7
WEST COAST	21A	14	7	7	7	7	7	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	3A	7	7A	14A	21A	21
ARGENTINA	14	14	7	7	7	7	14	21A	21A	21A	21A	21
AUSTRALIA	21A	14	7B	7B	7B	7B	7B	7B	14	14	21A	21A
CANAL ZONE	21	14	7	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7	7	7	3A	7	7	7A	21	21A	14	14	7
HAWAII	21A	14A	14B	7	7	7	7	7	14	21A	21A	21A
INDIA	7B	14B	7B	7B	7B	7B	7B	14	14	7B	7B	7B
JAPAN	21	14	7B	7B	7B	7	3A	3A	14B	14	14	21A
MEXICO	14	14	7	7	7	7	7	14	21A	21A	21	21
PHILIPPINES	21A	14	7B	7B	7B	7B	3A	7	14	14	14	21A
PUERTO RICO	14A	7	7	7	7	7	14	21	21A	21A	21A	21
SOUTH AFRICA	14	7	7	7B	7B	7B	14	21A	21A	21A	21A	14A
U. S. S. R.	7	7	7	7	7	7B	7B	21	14	7B	7B	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	14	7	7	7	7	3A	3A	7	14	21	21A
ARGENTINA	21	14	7A	7	7	7	7B	21	21A	21A	21A	21
AUSTRALIA	21A	21A	14	14B	7B	7B	7B	7B	14	14	21A	21A
CANAL ZONE	21	14	7	7	7	7	7	21	21A	21A	21A	21A
ENGLAND	7B	7	7	3A	7	7	3A	14	21	14	14	7B
HAWAII	21A	21	14	14	7	7	7	7	14	21A	21A	21A
INDIA	7B	21	14B	7B	7B	7B	7B	7B	14	7B	7B	7B
JAPAN	21A	21	14B	7B	7	7	3A	3A	14B	14	14	21A
MEXICO	21	14	7	7	7	7	7	14	21A	21A	21	21
PHILIPPINES	21A	21	14B	7B	7B	7B	7	7	14	14	14	21A
PUERTO RICO	21	7	7	7	7	7	7	14A	21A	21A	21A	21A
SOUTH AFRICA	14	7	7	7B	7B	7B	7B	14	21A	21A	21A	14A
U. S. S. R.	7B	7	7	7	7	7B	7B	14	14	7B	7B	7B
EAST COAST	21A	14	7	7	7	7	7	14	21A	21A	21A	21A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

NOVEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
	1 F/F	2 F/G	3 F/G	4 P/F	5 F/G	6 G/G
7 G/G	8 G/G*	9 P/F*	10 F/G	11 G/G	12 G/G	13 F/F
14 F/F	15 G/G	16 G/G	17 F/G	18 F/F	19 P/F	20 F/G
21 G/G	22 G/G	23 G/G	24 G/G	25 G/G*	26 F/G*	27 P/F*
28 P/F	29 P/F	30 F/G				

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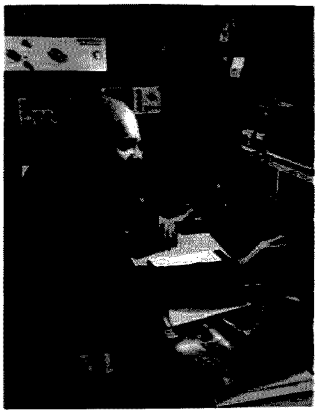
W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



SHOULD DXCC BE PROHIBITED?

The blatant arrogance of the PY0SB DXpedition shook the amateur bands, bringing on wild attacks of jamming in retaliation. Frankly, after trying to use the twenty-meter band for an hour, I didn't blame the jammers much. Not since Don Miller have I heard such a total disregard for the hobby.

This was, in my estimation, amateur radio at its worst. Those refugees from CB set up on one of the most rare spots in the world and then, transmitting outside of the American phone band, asked US hams to call them anywhere from 14,200 to 14,300. This went on, totally killing the band for any other use as thousands of stations called steadily, hour after hour. There was no possible way to make a normal contact anywhere in that entire band while this was going on.

This is totally unnecessary, as anyone with even a small amount of DXing experience knows. It is arrogant. It is a shameless flaunting of the power of one group to bring the whole band to a halt. It isn't even a fast way of making contacts. There is not even a remote excuse for such a display.

I've operated from some fairly remote spots and have faced as big pileups as anyone. I got started in seriously working DX in late 1945, the day our first DX band opened after the war. When I moved to New Hampshire, I started all over again, working 100 countries in the first week on twenty phone, 200 in the first month, and 300 in the first year. So I know the receiving end of the stick.

In 1958, I went on my first serious DXpedition...KC4AF, Navassa Island. Since then, I've operated from a bunch of places...come to mind 5Z4, ZS6, 3D6, 7P8, OD5, YK1, YA1, VU, 9N1, HL6, VR2, 5W1, KS6, FO8, HH, JY, OH0, KH2, KW6, and a bunch of non-rare countries. I've tried every way known to ham to get the most contacts per hour on the air from these rare places, so I have a good idea of what works and what does not work. Hmmm, I forgot to mention VP5, J6, and a revisit to Navassa in 1972.

The results of all this? Well, unless your signal is particularly weak, the fastest operation is when you operate on a fixed channel, thus containing the band mayhem to one single pileup. I've found that out by making regular announcements to this effect: "I will be listening for about ten seconds on this channel for the last letter of your call. Please do not all jump in immediately, but wait so your calls will be spaced a bit. I will make a note of the last letter of your call and call you with it after writing down as many as I can hear. Do not...I repeat...do *not* call more than a couple of times. If I hear anyone pushing and shoving on channel I will work you, but there will be no QSL. Neither of us wants that."

The result is a relatively orderly sorting out of the problem, which is to get the call letters of those on channel as quickly as possible. The rest of the contact is a matter of a couple of seconds. The long, hard part is getting the calls through.

By asking for the last letter, I am able to quickly get things down to two or three, at most, responding when I break. It makes everyone shut up and listen. I can then confirm the call, exchange signals, and be on to the next. With this system, I can double or triple the throughput of any system which calls for tuning a band of frequencies, looking for calls in the open.

The calling stations, perceiving that I am able to cope with the chaos and that they will have a fair chance of getting through, respond very positively and line up, doing as I ask. Megawatts of power are saved. The entire band, except for about 6 kHz which I am using, is open for everyone...and at least twice as many operators are made happy with a new one. And think of the agonizing frustration saved for the thousands of ops, calling hour after hour, hoping to get through.

Another solution to the whole problem would be, of course, to get the League to cancel their Honor Roll and DXCC certificates so we wouldn't have this enormous pressure to make a radio contact with some stupid island somewhere. That would spoil a lot of fun for thousands of us DXers, but it would at least stop such carnage as the Peter and Paul jokers dumped on us.

This whole DX thing, while it may be fun for amateurs in most of the ordinary countries, is a royal pain in the...er...ear for the ham who lives in a rare spot.

HAM BILL SIGNED

It began as S.929, turned into H.R.5008, and came out of the Washington mill as H.R.3239, but the effect is the same: sweeping changes in amateur radio.

The bill, which has been signed by President Reagan, will give hams more control over licensing and policing and may also expand the 5-year ticket into a license renewable every 10 years.

With this moneysaving measure, FCC-approved hams and ham organizations will be both writing and administering exams. However, the exams may be written only by a ham with at least the class license that the exam is for, and tests can be given only by hams with a higher-class license. Extras, of course, will be allowed to test Extras.

Amateur radio's traditional self-policing policies have also been given a shot in the arm by the bill. The FCC can now use hams to track down illegal transmissions and accept reports on illegal activities which have been filed by hams. This bill gives the FCC permission to "recruit and train" hams for this purpose, and these amateurs will also be allowed to send warning notices to offenders. However, the amendment does not give hams authority to officially charge violators.

The self-regulatory aspect of the bill is the brainchild of Sen. Barry Goldwater K7UGA, who drafted the initial version as S.929. But to get it enacted, the concepts of S.929 were incorporated into a larger house bill, H.R.5008, which addresses a wide variety of changes in the Communications Act of 1934.

Hams plagued by RFI will find some respite under this bill, which will "establish minimum performance standards for home electronic equipment and systems to reduce their susceptibility to interference from radio frequency energy." However, the bill does not affect equipment already manufactured.

Other changes in the Communications Act eliminate licenses for CBers and radio control operators. Though CB operators will still be expected to comply with regulations, the change allows the Commission to officially wash its hands of the 27-MHz band.—WB8JLG.

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You wouldn't believe how soon the thrill of working stations for ten-second contacts palls. You might not find it as difficult to believe what a nuisance being expected to fill out and mail thousands of QSL cards is. Imagine, if you will, the excitement with which a ham in Tonga receives his 780th QSL from a WB2 station. It just goes into the nearest leftover washing machine carton.

Even with a QSL manager to take on the brunt of the card chore, the responsibility for keeping the log, getting a copy to the manager, and forever making instant contacts, with growing resentment whenever you stop to try to make friends with anyone forcing you to shut down... it's driven most hams in rare spots off the air.

QSL OF THE MONTH: XE1JRV

This month's QSL Contest winner is Jesus Retana XE1JRV. This modern rendition of an ancient temple is highlighted by the bright yellow sun, adding warmth and contrast to an otherwise stark scene.

To enter *73*'s QSL of the Month Contest, put your QSL card in an envelope with your choice of a book from *73*'s Radio Bookshop, and send it to *73*, Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Entries without an envelope or book choice will not be considered.

With so many things of value which people can accomplish in this world, I am saddened when I see some ham who has gotten swept up in the DX Honor Roll excitement. What a frivolous waste of life it is to devote it to trying to make this silly list... and stay there... often at almost any expense.

Continued on page 172

Well... I Can Dream, Can't I? by Bandel Linn K4PP

"Are you the handsome one who advertised for 'Ham Help'?"

Stan Gibilisco W1GV/4
533 Coral Way, Apt. 14
Coral Gables FL 33134

The Hangman's 2-Meter Collinear

Make your tower do double duty. Drop this array from the top and get 6-dB gain.

Here is a 2-meter FM base-station antenna that's inexpensive, easy to build, and has about 6 dB omnidirectional gain. It can be mounted on the side of a tower or put on a mast of its own. No special tuning equipment is required. All you need is an swr meter.

Design

The antenna described here is a 6-element vertical collinear array. It consists of six half-wave radiators placed end-to-end and fed in phase. The resulting directional pattern is theoretically a circle in the horizontal plane, with a gain of about 6 dB over a dipole. Results of testing at W1GV/4 indicate substantial improvement, both for transmitting and receiving, over a 5/8-wave antenna with ground plane at 25 feet.

Fig. 1 shows the configuration of the collinear antenna. Each element is 38 inches long. The end-to-end spacing between elements is negligible, about 1 inch. Allowing for a foot or two at the top and bottom, the entire antenna requires a vertical space of about 22 feet. Of course, the higher the system is placed, the better the performance will be.

Proper phasing is obtained by quarter-wave stubs between the elements. For all practical purposes, these stubs do not radiate, provided they are cut to the correct length. At 146.5 MHz, 18 inches with 2-inch spacing gives a reasonant, ultra-low-loss matching section. Fig. 2 illustrates the construction details for each stub.

The antenna can, as previously mentioned, be mounted on the side of a tower or alongside a TV mast; it can even be hung from a tree branch! If the antenna is mounted on the side of a tower, the directional pattern will be modified slightly. The gain will be reduced in the direction of the tower and increased in the direction away from the tower. Therefore, you should position the antenna to provide the most gain in whatever direction you desire the best coverage (Fig. 3).

If the antenna is suspended next to a TV mast or hung from a tree limb, the pattern will be omnidirectional.

Construction

To put this antenna on a tower, you will need the following hardware, in addition to the usual tools and soldering apparatus:

- 6 42-inch lengths No. 12 solid uninsulated copper wire

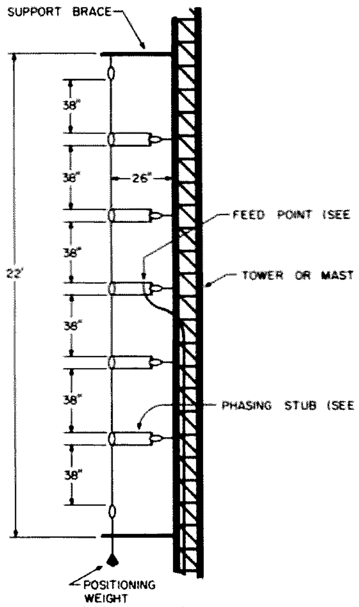

Fig. 1. Configuration of the 6-element, 2-meter wire collinear antenna. The overall height is 22 feet. The array is fed at the physical center.

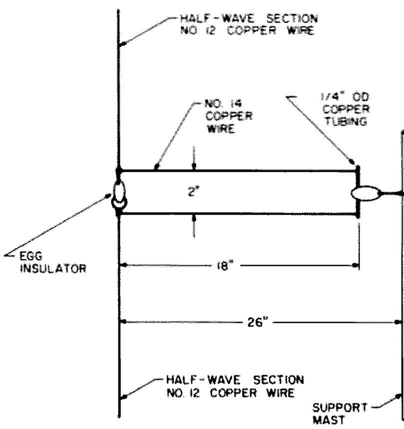

Fig. 2. Construction details for the tuning stubs. A spacing of 2 inches provides minimum loss while allowing essentially no radiation. When the stub is pulled tight, the wires will stay in place because of their stiffness.

● 10 20-inch lengths No. 14 solid uninsulated copper wire
● 1 20-foot (approx.) roll No. 12 solid wire
● 5 2-inch lengths 1/4-inch o.d. copper tubing
● 5 porcelain insulators (non-egg type)
● 7 small egg insulators
● 2 3-foot, 2-inch o.d. wooden dowel rods
● 2 screw-in-type TV standoff insulators
● 1 15- to 20-pound weight
● 1 roll of electrical tape
● 1 strong set of legs

First, screw the TV standoffs into one end of each dowel. Then, attach the rods sideways to the tower braces, 22 feet apart. (If the tower braces do not exactly line up to 22 feet, use the next brace that will allow a spacing greater than 22 feet.) Of course, the higher the overall position, the better! The dowels should extend 26 inches out from the tower. Use No. 12 wire to secure the dowels to the tower braces.

To assemble the antenna, attach the seven egg insulators at the ends of the six antenna elements, making a long chain. Wrap and solder each wire end to the egg insulators. To minimize interelement capacitance, it's best to loop the wires through the egg insulators as shown in Fig. 2, in such a way that if the insulator should break, the wires will come apart. The elements should each measure exactly 38 inches from loop tip to loop tip. Attach an 18-inch length of No. 12 wire to one end of the array and a 48-inch length to the other end.

To construct the phasing stubs, solder two 20-inch lengths of No. 14 wire to each element end (see Fig. 1). Wrap 1 inch of wire around each element end. Space the wires 2 inches apart. Put a 2-inch piece of copper tubing through one end of a standard porcelain or glass insulator and twist a short piece of stiff wire

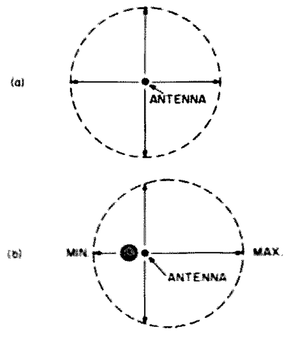

Fig. 3. Radiation patterns for a vertical array in free space (a) and near an obstruction such as a tower (b). The viewing position is directly overhead. The obstruction tends to reduce the gain in some directions while increasing it in others.

around the tubing if necessary to keep it from slipping up and down in the hole. Wrap 1 inch of the free ends of the stub wires around the ends of the tubing and solder them in place. When you are done, you should be able to pull the stub tight and have both wires evenly spaced, straight, and 18 inches long (Fig. 2). You will have to construct five of these stubs, in locations shown by Fig. 1.

Now you're ready to hang this contraption. Grab the top end—the one with the 18-inch piece of wire attached—climb the tower (don't forget your safety belt!), and affix the wire to the TV standoff insulator at the end of the upper dowel. Then, climb back down to the lower dowel and run the 48-inch end wire through the standoff insulator there. Rotate the plastic inside the standoff so the wire can't pop out, and crimp the insulator ring to keep it in place. Cut the lower wire so that roughly 8 inches remains below the standoff. Then attach the weight to the end of the wire (Fig. 4). This weight keeps the array taut as the wires expand and contract with changes in temperature. An alternative arrangement to the weight is

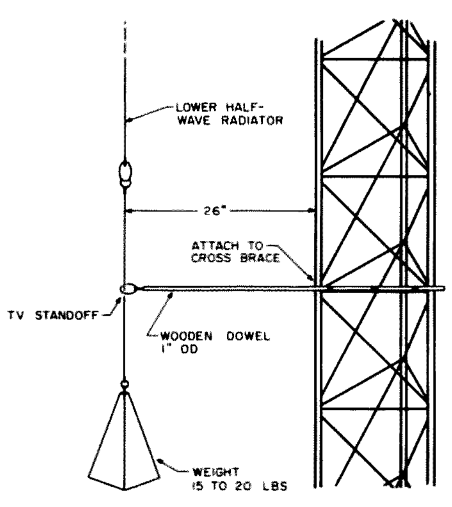

Fig. 4. Arrangement for keeping the array taut. The distance between the weight and the TV standoff should be great enough to allow for contraction with cold weather, but small enough to prevent excessive swinging of the weight.

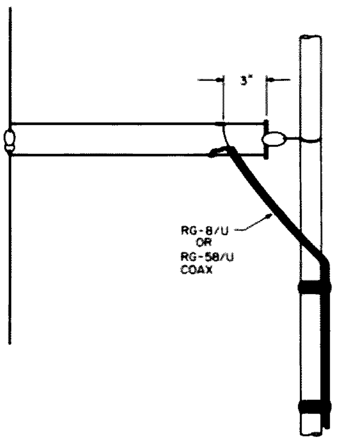

Fig. 5. Feedpoint diagram. The array should be fed at the center stub. A good starting point is 3 inches from the shorted end; however, some adjustment will probably be necessary to get a perfect match. Here, the center conductor of the transmission line is connected to the top part of the antenna and the shield to the bottom part. However, they could just as well be reversed.

to use an elastic band in place of the lower section of wire; however, the array may have a tendency to "oscillate" in the wind if this scheme is used.

To position the stubs, you'll need five pieces of wire about two feet long. Run one end through the insulator at the end of the stub, twist the wire onto the insulator, and pull the stub reasonably tight. Twist the other end of the wire around the tower support nearest the array (Fig. 2).

The Feedpoint

You can rest a bit now. As you're sipping a cool drink, admire the new appendage to your antenna farm. But don't get carried away; you still don't have it hooked up. And the final tuning procedure may require three or four more excursions up the tower.

Fig. 5 shows the matching section for the 6-element wire collinear. The transmission line is connected to the center stub. A good starting point

is 3 inches from the shorted end, as shown. However, you'd better not solder the wires there right away. The size of your tower will have some effect on the exact final position. Larger towers will lower the impedance for any given tap point, as compared to smaller towers.

The feedpoint should be moved slightly toward or away from the shortened end of the stub until the swr is minimum at 146.5 MHz. It should be possible to get a nearly perfect match (at W1GV/4, a 1.3 swr was obtained). Always keep the coax shield and center-conductor taps at the same distance from the end of the stub; don't try to get fancy by putting them in different places.

The final tap position will be about 15 percent of the way from the shorted end of the stub to the antenna end. When the ideal position has been found, solder the wires in place and wrap the connections with electrical tape. Or, better, use silicone rubber cement. Tape the feedline cable to the inside of the tower to minimize possible induced currents on the coax from antenna coupling.

Closing Remarks

This antenna is a pleasure to use and requires essentially no maintenance. Since it is made from materials usually available at flea markets, the cost can be very low. I had much of the necessary hardware already in my junk box.

A gain of 6 dB over a dipole represents a quadrupling of the effective radiated power. But you get this gain on receive, too! With my Azden PCS-3000 at 25 Watts, I'm running 100 Watts effective radiated power, neglecting line losses. My installation, being attached to a TV mast with the bottom almost at ground level, is essentially omnidirectional. It is generally possible, in this pancake-flat South Florida area, to communicate with mobile stations via simplex out to 50 or 60 miles. Before, with the 5/8-wave antenna at 25 feet, the reliable range was only 30 to 40 miles. Of course, repeater operation is a breeze. I'm full-Q into all of the local repeaters.

There isn't any reason why more elements cannot be added to this array, except for height limitations and certain engineering requirements. An 8-element array would require about 28 feet of vertical space and would produce about 7.5 dB gain over a dipole; a 10-element array would give around 8.5 dB gain.

As the number of elements is further increased, tuning of the stubs and elements becomes more and more critical, and special equipment will be required to ensure correct phasing for optimum performance. (Even with a 1-inch error on each element, the total discrepancy would be 5 inches at the top and bottom of a 10-element array; this is 23 degrees at 146.5 MHz! Such an imprecision would surely degrade the performance of the antenna.) Furthermore, as the number of elements increases, the bandwidth of the array gets narrower because the error adds up for each element off resonance. There is a point of diminishing returns.

A 6-element array can provide good communication without the headaches of painstaking adjustment and narrow bandwidth, and so it represents a good compromise. This antenna is ideal for the 2-meter FM operator who wants omnidirectional operation, but is presently using only a ground plane.■

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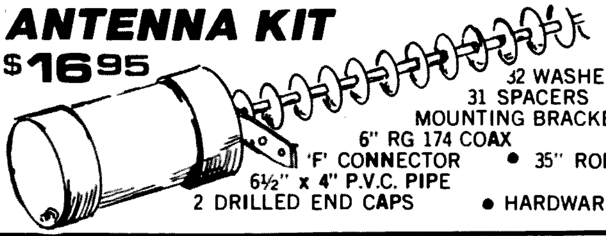

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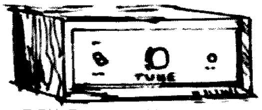

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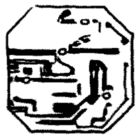

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Deep-Six Squelch Tails

Kerchunks take a dive with the addition of this audio delay.

Squelch tails are ugly. Few things are more annoying to repeater users than a long squelch tail every time someone drops his carrier. At WR3AFM, a Baltimore Amateur Radio Club (BARC) multiple-receive-site repeater,[1] this problem is compounded by a second squelch tail, that of the link receiver. The resulting overall squelch tail is approximately 110 milliseconds in duration. However, thanks to the circuit described below, it is no longer audible.

A squelch tail is the noise heard at a receiver's audio output after the transmitting station has dropped its carrier but before the receiver's squelch circuit can mute the audio output. This is what you hear whenever the repeater carrier drops off the air, for example. The duration of the squelch tail is a function of your particular receiver.

Another source of squelch tails is a repeater receiver. Consider first a conventional single-site machine. Whenever the transmitting station drops its carrier, the repeater receiver's output follows with a burst of squelch noise. Since the repeater transmitter is still on the air at this point, this squelch tail is heard by all stations monitoring the machine.

Next, consider a split-site repeater (or a multiple-site repeater like WR3AFM) as shown in Fig. 1. In this type of setup, the repeater receiver (or each satellite receiver in a multiple-site scheme) is coupled to the repeater transmitter via a link, often on 450 MHz. The repeater receiver operates as before, appending a squelch tail to each transmission. The receiver output is sent by the link transmitter to the repeater transmit site, where it is received by the link receiver. When the link transmitter carrier drops, shortly after the repeater receiver squelch tail ends, the link receiver will append a squelch tail of its own to the audio output. Since the link receiver feeds the repeater transmitter (or voter, in the multiple-site case, which, in turn, feeds the transmitter), this (link) squelch tail also is heard by all monitoring stations.

In order to eliminate the squelch tail nuisance, a delay line was inserted into the audio-signal path. To see how this will allow the squelch tail to be silenced,

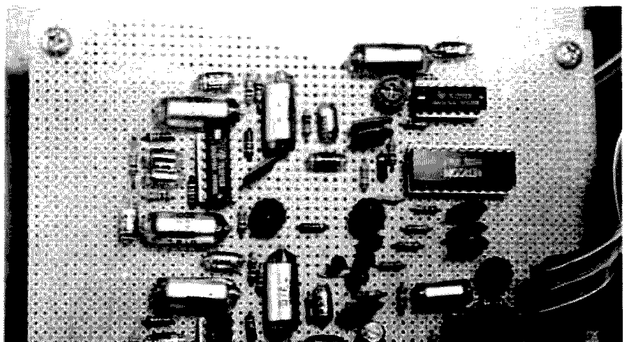

Photo A. The completed board installed at WR3AFM. The delay line is in the upper right. The I/O connector is in the far right. (Photo by N3IC)

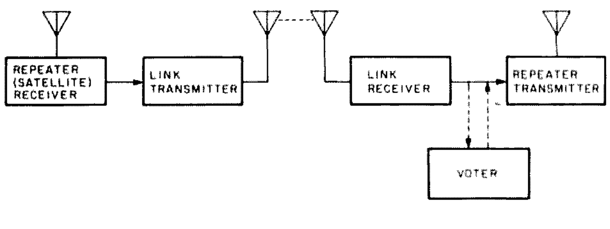

Fig. 1. Split-site (or multiple-site) diagram.

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refer to Fig. 2. Note that although the figure specifically illustrates the multiple-site (or split-site) system, by ignoring the link (second) squelch tail it is valid also for a single-site system.

Fig. 2(a) shows the audio output of a satellite receiver and its associated squelch tail. This signal is sent via a link transmitter to a link receiver, and from there to the voter, with the added link receiver squelch tail. The audio output of the voter, shown in Fig. 2(b), contains the satellite receiver squelch tail and the link receiver squelch tail. The carrier-operated switch (COS) depicted in Fig. 2(c), with logic high equivalent to on and logic low equivalent to off, changes state after both squelch tails are completed. Since the COS is usually employed to gate (switch on or off) the repeater transmitter audio (or the transmitter itself), both squelch tails are transmitted by the repeater.

Fig. 2(d) shows the voter audio output delayed in time. It can be seen that the squelch tails in Fig. 2(d) occur after the COS goes low. Using the COS signal to gate the audio in Fig. 2(d) gives Fig. 2(e). This audio contains no squelch tail at all.

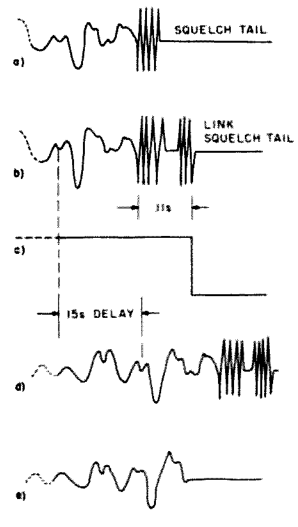

Fig. 2. Using delayed audio to eliminate squelch tails. (a) Repeater (satellite) receiver audio output. (b) Link receiver audio output. (c) COS. (d) Delayed link receiver (voter) audio output (e) Gated repeater transmitter audio.

The length of the satellite-receiver squelch tail is somewhat dependent on the received signal. Since the link transmitters and receivers are fixed, the link squelch tail is always the same length. To take this variability into consideration, the length of the delay was chosen to be longer than the worst squelch tail usually encountered. This ensures absolutely no transmitted squelch tail, but also chops off a small amount of audio in some cases. At worst, however, if the carrier is dropped immediately following a word, one syllable might be lost. This turns out to be insignificant in practice. Of the almost 500 members of BARC, only one seems ever to have problems with lost syllables, and then only on one-word transmissions! Overall performance has been great, and the total parts cost of approximately $70 puts the project within reach of most everyone.

General Theory

A block diagram of the overall system is shown in Fig. 3. Starting with the delay itself, the various blocks will be examined.

The heart of the circuit is a Reticon R5101 Charge-Coupled Device (CCD) which performs the delay. The CCD acts as an analog shift register. It stores time samples of the analog input signal as packets of charge. The amount of charge in each packet is proportional to the amplitude of the analog input at the time of sampling. The packets of charge are shifted through 2000 stages before they reach the output of the CCD. Thus, the chip has 2000 samples of the input stored at any given time, each separated in time by T seconds, where T is the time between samples. The CCD uses two clock cycles per shift, and hence the overall delay time (Td) is given by $Td = 2000 \times (2/Fc)$, where Fc is the clock frequency supplied by the oscillator block and is equal to 2/T.

Instead of using a CCD, other schemes could be used to achieve the desired delay. These include tape loops and digital sampling, which are discussed briefly below.

The tape-loop scheme involves continuously recording and simultaneously playing back the received audio on a tape recorder. Since there is a physical gap between the record head and the playback head, a time-delay is introduced ($Td = G/V$, where G = gap length in inches and V = tape speed in inches per second). A Td of up to one second is typical at slow tape speeds with this approach. This scheme is the simplest to implement, but was not used because of the problems of reliability of such factors as the tape transport mechanism, tape breakage, and dirt on the tape heads.

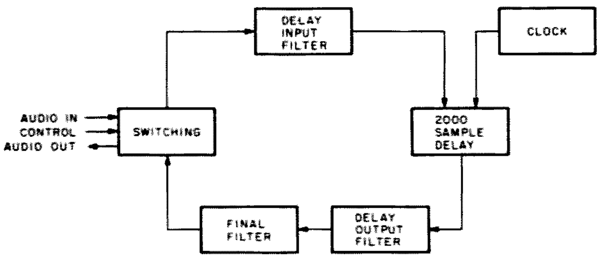

Fig. 3. System block diagram.

The digital-sampling scheme is similar to the CCD technique except that the audio signal is first digitized by an analog-to-digital converter, then stored in a digital shift register, and finally converted back to analog form by a digital-to-analog converter. This approach has the advantage of being able to achieve any desired delay by adding more shift registers. To get a reasonable signal-to-noise ratio and still preserve the dynamic range of speech, we would need either many bits (12 or more) in the digital words or we would have

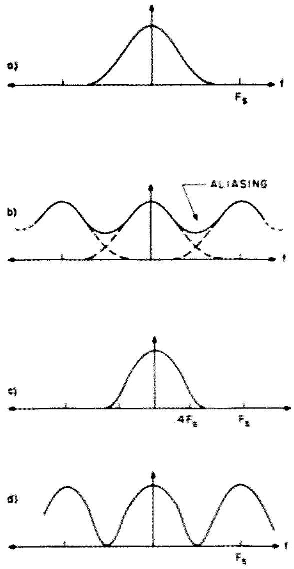

Fig. 4. Aliasing. (a) Spectrum of signal to be sampled at F_S (b) Spectrum after sampling without first low-pass filtering. (c) Spectrum of input signal after low-pass filtering with cutoff at .4 F_S. (d) Spectrum after sampling the low-pass-filtered signal.

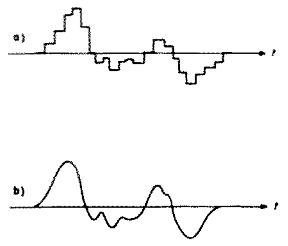
Fig. 5. CCD output filtering. (a) Before filtering. (b) After filtering.

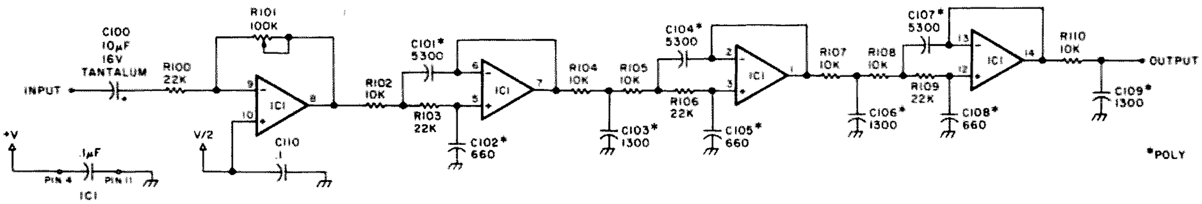

Fig. 7. Delay input and delay output filtering. Note: IC1 and IC2 are TL074Cs. IC1—100 series; IC2—200 series.

Frequency (Hz)	Gain (dB) (I/O 2 to I/O 6)
12	−3
20	−1.32
50	−.21
100	0
1k	.53
2k	1.59
2.2k	1.63
2.37k	1.59
3k	0
3.43k	−3
4k	−10
5k	−30
6k	−51

Fig. 6. Measured overall response. Conditions: 1) Delay = 150 ms (F_{clock} = 26.67 kHz); 2) two-pole adjustable low-pass filter set for 0 dB at 3 kHz.

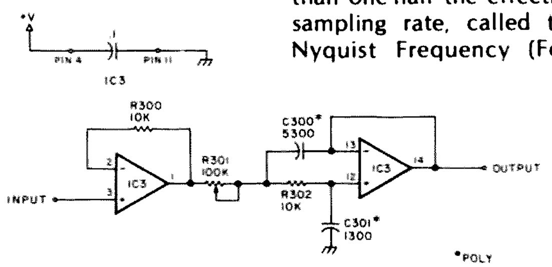

Fig. 8. Final filter. IC3 is a TL074C.

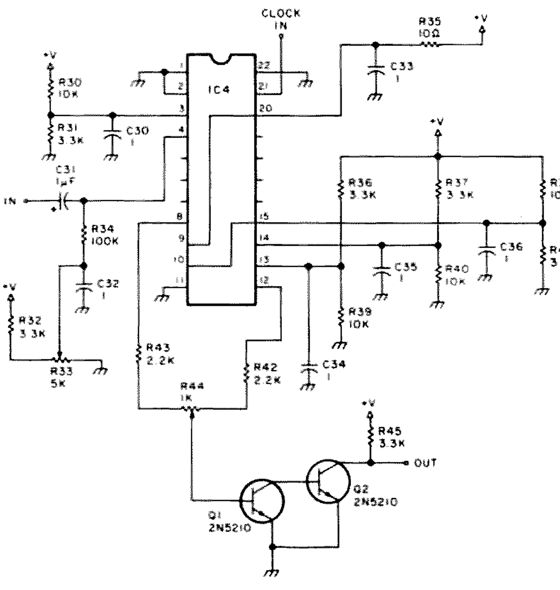

Fig. 9. 2000-sample delay. IC4 is a Reticon R5101.

to use a compression-expansion (companding) technique. Either way, due to the high cost of analog-to-digital converters and digital memory (the shift registers) and because of its higher total package count, these approaches were undesirable.

As in any time-domain sampling system, the input must be a band-limited process. In a low-pass application, such as with speech, any input components whose frequency is greater than one-half the effective sampling rate, called the Nyquist Frequency (Fc/4 here), must be removed prior to sampling to prevent a form of distortion called "aliasing." If not removed by filtering, these components will appear at the output as lower frequency (alias) signals (see Fig. 4).[2] Once aliasing occurs, it cannot be removed by filtering, since the aliased components are indistinguishable from the original components. The necessary filtering is performed here by a 3-section, 9-pole low-pass filter.

Since the CCD is a discrete time system (that is, its output changes only at specific times, resembling a staircase), the output also contains high-frequency terms which must be removed by filtering (see Fig. 5). This filtering is again performed by a 3-section, 9-pole low-pass filter.

Since the frequency response of the CCD is somewhat dependent on the clock frequency selected, a tunable low-pass filter is provided. By tweaking this filter, the overall response may be optimized for a particular clock rate. The response for the board at WR3AFM is given in Fig. 6. The tunable filter was set so that the response at 3 kHz was equal to that at 100 Hz (0 dB). Notice the excellent flatness over the speech bandwidth (−0 dB, +1.6 dB). The steep roll-off past 3 kHz also serves to attenuate wideband noise from other sources preceding the delay line.

Variable-gain input and output buffers are provided. The input buffer is set to limit the input to the CCD to less than 1 volt peak to prevent overloading the device, and the output buffer is set to achieve unity overall gain (0 dB) at 100 Hz. Thus, the whole board is transparent to the rest of the repeater.

The switching stage allows the delay to be bypassed (if desired) and permits the audio to be gated with the COS signal. This eliminates the need for any external audio switching.

Circuit Design

Filters

The circuit was designed in a fairly straightforward manner. Quad bi-FET op amps were chosen because their high input impedance makes designing with them simple. Specifically, the TL074 is a low-noise version of the popular TL084, which could be substituted, as could many other audio op amps.

Since the frequency response of the CCD starts to roll off at about 1.5 kHz when set for a 150-millisecond delay, some form of equalization was required to extend the usable bandwidth of the system. High-frequency pre-emphasis (that is, boosting the high-frequency components ahead of the CCD, as opposed to post-emphasis) has the advantage that the input signal is kept large with respect to the noise at all times. However, since the CCD overloads at about 1-volt peak input, any boost in the spectrum ahead of the CCD must be accompanied by an overall cut in the input level (relative to that permissible with no pre-em-

phasis). Post-emphasis completely avoids this problem, but it also boosts any noise added by the CCD circuitry. As a compromise, equal amounts of pre- and post-emphasis were employed.

The low-pass filters were designed to provide the needed boosting as well as to attenuate the high-frequency components. In order to achieve a 150-millisecond delay, Fc = 26.67 kHz from the equation, above. Thus, the Nyquist Frequency (Fc/4 here) is 6.67 kHz. The low-pass filters must attenuate at and above this frequency. The 9-pole filters shown in Fig. 7 have a peak (boost) of approximately 6 dB before rolling off at −54 dB/octave. The overall response is shown in Fig. 6.

The final output filter, a buffer and 2-pole low-pass filter combination, is shown in Fig. 8.

CCD/Clock

Fig. 9 shows the circuitry surrounding the CCD that was suggested by the manufacturer, which was found to work well. The clock signal is produced from a simple two-inverter oscillator and is shown in Fig. 10.

Switching

Since WR3AFM is controlled by an 8080 microprocessor, all control signals are supplied by TTL open-collector outputs. Thus CMOS 4066 analog switches were a natural choice to handle the audio gating. The switching circuits are shown in Fig. 11.

Construction Notes

The board was built using point-to-point techniques. The actual layout, shown in Fig. 12, was carefully planned to ensure neat wiring and no ground loops. Any popular construction technique should work. Whatever method is used, however, the ground leads should be heavy enough to keep op-amp noise reasonable.

All op-amp Vcc inputs were bypassed to ground with a .1-uF disc capacitor right at the chip, on the underside of the board. Polystyrene capacitors were used in the filters to achieve close tolerance and good temperature stability. Sockets were used for all chips, with the one for the CCD being a must.

The input and output audio, switching, and power-supply connections can conveniently be made using ribbon cable and a 14-pin DIP socket. A suggested pin configuration is shown in Fig. 13. Unused lines should be grounded at the board end only, to reduce noise and prevent ground loops. The ground lead from the DIP socket should be connected to the ground bus on the board at the spot that results in the smallest amount of noise on the audio-output line. In the layout shown in Fig. 12, the best spot was found to be near the inverter chip.

Finally, as shown in Fig. 14, a 10-uF filter capacitor was placed from Vcc to ground and from Vcc/2 to ground. Tantalum capacitors were used because of their small size and low leakage, but any type capacitor will do.

Parts

The CCD is available for $50 from Reticon Corporation, 910 Benicia Avenue, Sunnyvale CA 94086, and their distributors (write to them for info). For most other parts, a good supply house is Digi-Key Corporation, PO Box 677, Thief River Falls MN 56701.

Adjustment

To set the clock fre-

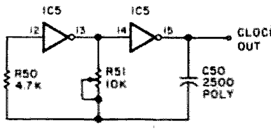

Fig. 10. Clock. IC5 is a CD4049AE.

quency, adjust R21 while observing pin 15, IC5, on a scope or frequency counter. The desired frequency may be found from the equation, above. For a 150-millisecond delay, Fc = 26.67 kHz.

R101 is adjusted to prevent overloading the CCD. Since the maximum pre-emphasis is 6 dB, the maximum signal at pin 8, IC1, must not exceed .5 volts peak for any input signal. However, to achieve the best signal-to-noise ratio, it is desirable to keep the signal as large as possible. Therefore, apply a sine wave at the maximum level to be encountered in operation (such as the level that gives 5-kHz deviation on the repeater) to the input (I/O pin 2) and adjust R101 until the level at pin 8, IC1, is .5 volts peak.

To adjust the bias and symmetry of the CCD, apply an audio-frequency sine wave to the input (I/O pin 2). Adjust the amplitude of the sine wave until distortion is just evident at pin 14, IC2. Next, set R33 and R44

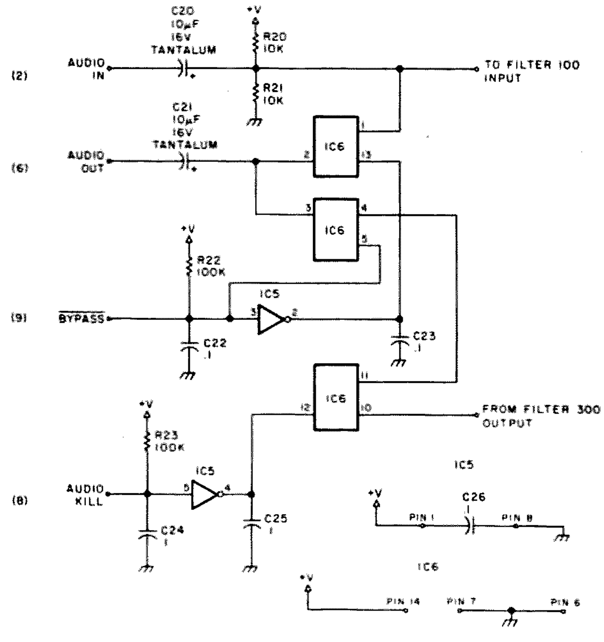

Fig. 11. Switching. IC6 is a CD4066.

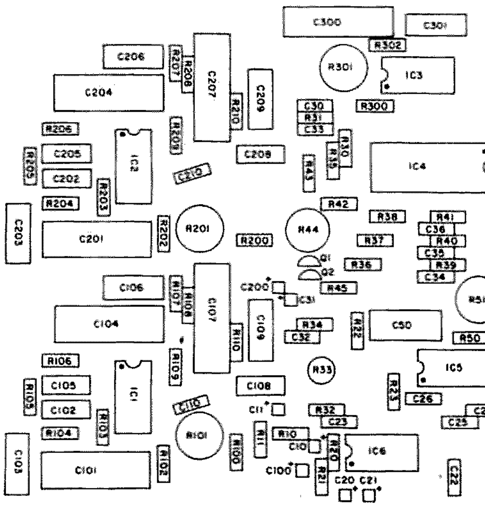

Fig. 12. Parts layout.

to minimize the distortion, and then increase the input until the distortion is again visible. Continue this process until no further reduction in distortion is observed.

Adjust R301 so that the overall gain is equal (I/O pin 2 to I/O pin 6) at 100 Hz and 3 kHz. This gives a desirable response for a voice channel.

Finally, adjust R201 so that the overall gain (I/O pin 2 to I/O pin 6) is unity (0 dB) at 100 Hz (or 3 kHz).

Pin 2—Audio input
Pin 6—Audio output
Pin 7—Ground
Pin 8—Audio kill
Pin 9—$\overline{\text{Bypass}}$
Pin 14— + 12 volts

Fig. 13. I/O connector wiring.

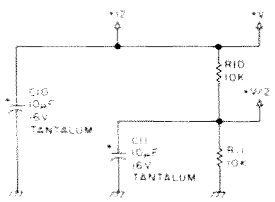

Fig. 14. Power supply filtering.

Echoes, Etc.

Since the unit introduces delay in the audio path, a rather interesting echo effect can be observed. Referring to Fig. 15, notice that due to the delay some audio output continues from the repeater after the transmitting station's carrier drops. The length of this audio is equal to the length of the combined squelch tails. Depending on the speed of the station's T-R switching, the operator will hear the end of his transmission coming back.

The only drawback of the device also is visible in Fig. 15. The final portion of audio is chopped by the circuit. The amount of audio lost is equal to the difference between the length of the delay and the length of the combined squelch tails. Since the usual squelch tail lasts for 110 milliseconds (at WR3AFM), if a short squelch tail was acceptable, the delay could be shortened to 110 milliseconds. In practice, almost everyone holds their PTT for a short amount of time after they stop speaking, so this is really a moot point.

The delay also causes a strange phenomenon if an operator is monitoring the repeater on a secondary receiver. It is virtually impossible to talk while listening to your own voice delayed by 150 milliseconds. This effect has encouraged the more fun-loving walkie owners to engage in the friendly game of sneaking up behind an unsuspecting repeater user while he is transmitting and then turning up the volume on the walkie. This fun alone justifies the work involved in building the delay line. ■

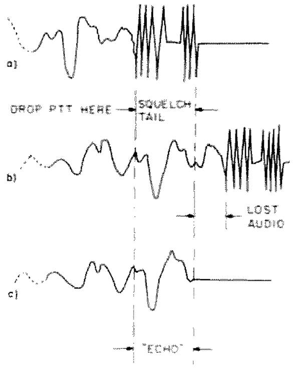

Fig. 15. Echo. (a) Transmitted audio plus squelch tails. (b) Delayed audio. (c) Repeater output.

References

1. Glaser, R., "An 8080 Repeater Control System," *73 Magazine*, February, 1979.
2. For a more complete discussion of sampling and signal processing in general, see, for instance, Schwartz, M., *Information Transmission, Modulation, and Noise*, McGraw-Hill, 1970 (second edition), or Rabiner, L. and Schafer, R., *Digital Processing of Speech Signals*, Prentice-Hall, 1978.

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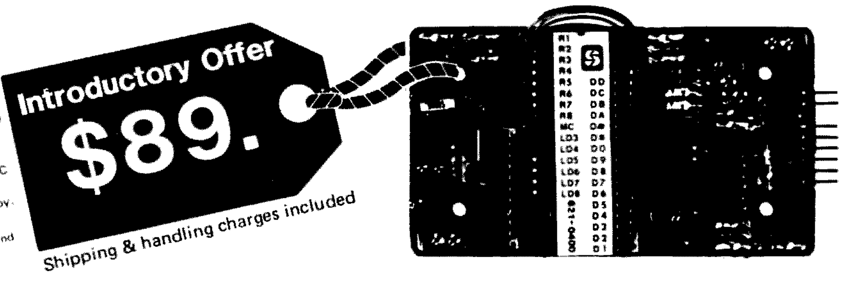

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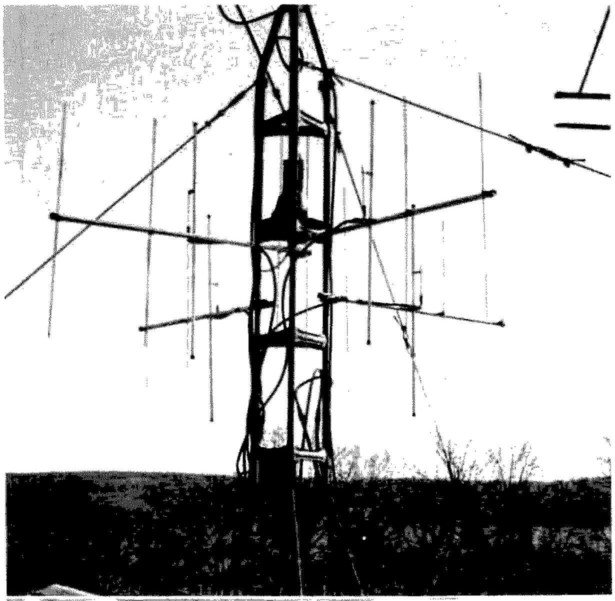
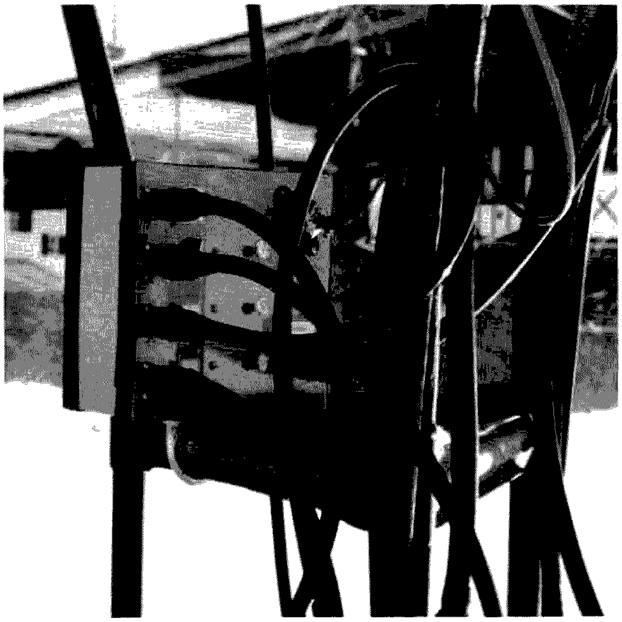
"Five-nine here in Northern New Jersey, OM. 73 and thanks for the point. Anyone else calling?" Bzzz, whoosh "three" sputter, bzzz, whrrr. "Oh, gosh . . . the W3 calling, you're in the noise here, but you're off the back of the beam; I'll start turning in your direction . . ." Click, click, click . . . 30 seconds later . . . click, click, click. "OK, now the W3 who was calling, are you still there? Try again now."

What a waste of time to be constantly turning beams during a VHF contest. Especially on FM, where a good operator in the metropolitan area can run 60 or more contacts per hour on 146.52 MHz or other popular simplex channel, if only he doesn't have to spend half his time turning a beam. But in a densely-populated area (and there are many such regions in the US) one simply cannot use an omnidirectional



The four A147-4 beams installed on the tower.



The relay box mounted on the tower. Note the well-taped PL-259s.

gain array, due to high QRM levels. What to do? Thought you'd never ask.

How about four vertical yagis, aimed at compass points or areas of known activity, side-mounted on your tower or mast, with remote switching from a single feedline? Too expensive? Not really. Cumbersome? Not as much as a rotator. Tricky? Not at all. Simple, in fact, and requiring little time or homebrewing expertise. And the benefits are attractive, not only to the VHF contester, but to any active FMer; of course, the principle described lends itself to a variety of other interesting applications, such as diversity reception experiments or phasing of HF steerable arrays.

Personally, I used four Cushcraft A147-4 short-boom 4-element 146-MHz yagis, for their ease of matching to an unknown line impedance, light weight, and low cost. If all the control box parts listed in the parts list are purchased new at list prices per the 1980 Allied Electronic catalog and added to the *73* advertisers' prices for the coax and antennas listed, the total cost of this entire project is $159.88. The only additional expense would be the feedline (hardline sells for 49¢ per foot from several *73* advertisers), the hardline connectors (brand new for $8.00 each from Phelps-Dodge, or available for much less at flea markets), and the 4-conductor control cable (the Belden cable listed sells for $12.00 per 100' list price).

Sound like a lot of dough? I agree; that's why I bought most of the stuff (except for the antennas) at local surplus stores, which brought the cost of this project down to less than sixty bucks (minus antennas). The Cushcraft antennas specified sell for $21.00 each, but could be replaced with home-brew antennas—either yagis or quagis—for a fraction of that.

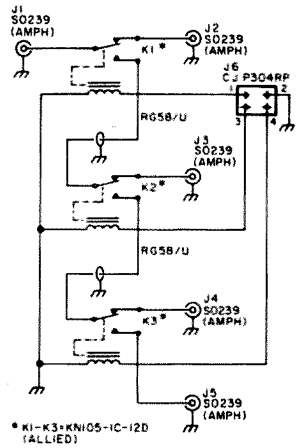
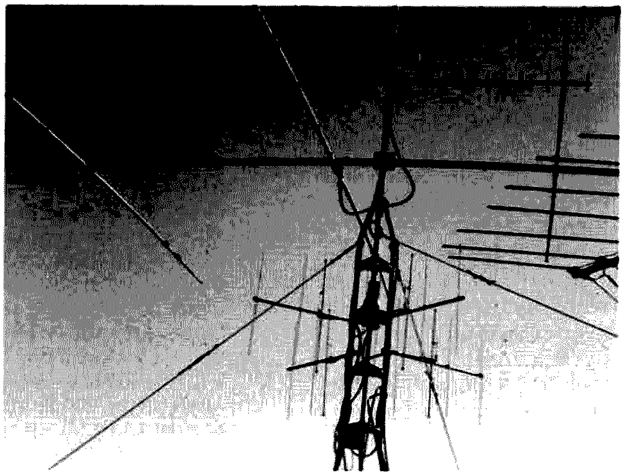


Fig. 1. Relay box.

The A147-4s were selected here because they are small and light, they are end-mount types ideal for direct tower mounting, and they develop slightly over 6 dB gain, which is a tad more than my omnidirectional Phelps-Dodge Stationmaster. The Stationmaster, a well-respected, 20-foot-long fiberglass monster, sells for about $240.00; my 4-beam system works as well, and offers the advantage of selectable directivity for QRM reduction . . . and it costs far less.

See Fig. 1 for the circuit of the relay box and Fig. 2 for the control box. Real Novice stuff. Mount K_1, K_2, and K_3 in a line on one flat, removable panel of the Bud AU-1029 cabinet. Mount the four output SO239 connectors in a line parallel to and about an inch away from the relays. Mount the SO239 "common" or "input" connector an inch from K_1, on the opposite side of the relay from the four output connectors. Mount the Cinch Jones P304RP connector in whatever space is left on the same panel. Now all components and all wiring are on just one flat aluminum panel. The rest of the utility cabinet is only a weatherproof box for the relays.



Here you can see the company the four A147-4s have: 4 el on 20, 15, and 10 meters; 19 el on 70 cm; 16 el on 2 meters. Guys are broken up with ceramic insulators.

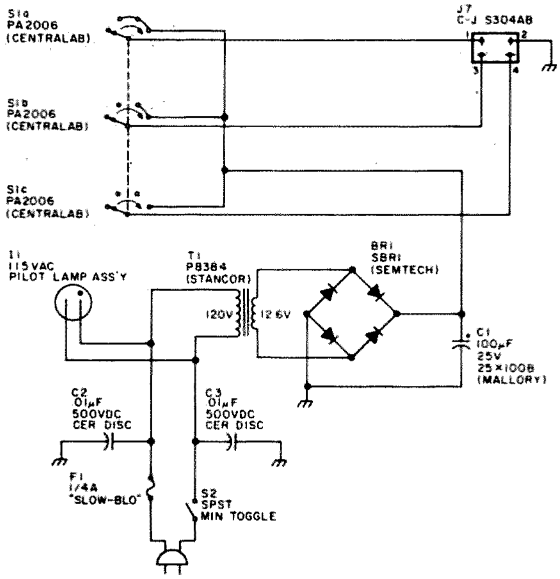


Fig. 2. Control box.

Use the flattened braid from RG-58/U for the connections from each UHF receptacle to each corresponding relay terminal, per the schematic in Fig. 1. Keep these braid jumpers as short as possible—mine are about one inch long each. If this box is intended for use at 146 MHz, this is important. Use short lengths of RG-58/U to make the K_1-to-K_2 and K_2-to-K_3 jumpers (see Fig. 1), keeping all exposed leads short. Solder the RG-58/U braid to ground lugs installed near each relay for this purpose.

The three relay coils must operate independently but they can have a common ground: thus, the wiring shown and the four-pin connectors.

After all the wiring in both the relay and control boxes is completed and double-checked, make up a short 4-conductor cable with the appropriate Cinch Jones connector at each end, and bench-test the two

units together. The dc output from the bridge rectifier should measure slightly over 17 volts with the rotary switch in position 1 (no load). This will drop to less than 17 volts with the switch in position 2, and then to about 16 volts in positions 3 and 4. The 12-volt relays specified seem to handle the slight overvoltage (and resultant overcurrent) just fine—their coils do not get hot even after hours of applied voltage. The maximum power dissipated in each relay coil is about 1.8 Watts.

Before the final installation of the relay box, drill two holes through one side of the box for a suitable U-bolt to clamp the box to your tower leg or mast. Then assemble the box on the tower or mast and caulk all corners and joints with the specified silicone caulking compound. I also wrapped the corners with Scotch 33 vinyl electrical tape.

The relay box provides a nice low vswr through about 50 MHz, but at 146 MHz it does not. Using my Bird model 43 wattmeter, a range 25C slug, a Dielectric Communications model 4050 50-Ohm, 50-Watt microwave dummy load, and a 146-MHz, 25-Watt transmitter, I measured the vswr looking into the box (with each output terminated in the 50-Ohm load) and found it to be less than 1.5:1 in position 1, but over 2:1 in the other three positions. However, there was no actual *loss* through the relays, just an impedance mismatch. What to do? Simple; tune the antennas to match the box!

Here's what to do to make it all work well at 146 MHz:

● Connect each antenna, once mounted in its permanent position, to its respective port on the box, using the 64" RG-8/U foam cables and PL259 connectors. The 64" is a nice length because it reaches, and also because it is one wavelength (in foam cable) at 146 MHz, thus making the box think the antenna is coupled directly to it.

● Connect the control box to the relay box with a length of 4-conductor cable. Locate the control box on your roof or tower for this temporary arrangement.

● Connect a 10-to-25-Watt two-meter exciter through 50-Ohm cable (any length) to a 50-Ohm coupler (I used a Bird 43) which is connected directly (like with a double-male UHF adapter) to the "common" port of the relay box.

● Apply power to the rig and the control box. With the control box switch in position 1, transmit and measure vswr. If it's low, great. If not, adjust the gamma match on antenna 1 to bring reflected power to a minimum.

● Perform the same gamma-match adjustments on antennas 2 through 4, switching to each in turn by using the control box. It should be possible to bring the vswr of each antenna down to reasonable proportions with the gamma match provided on each A147-4.

Now the system is adjusted. Remove the wattmeter, etc. Locate the control box in the shack, run the feedline and control cables down into the shack, and you're on the air.

Voila! A really high-class antenna system in just an afternoon's work. My whole installation (pictured) took about four hours, including wrestling with the hardline. The two boxes took just one evening to assemble. It was worth it. As you can see in the picture, I do own a Stationmaster for 146-MHz FM work, and although it is an excellent antenna, it is 20' long, weighs over 25 lbs., catches a lot of wind (and ice), and cost over $200.00. The four beams are more versatile, occupy less space, work at least as well, and were far less expensive.

Now, when I hear a weak station calling, I can "turn the beam" in less than one second to pull him in. What a difference! ■

Parts List

4	lengths of RG-8/U foam coax (Belden 8214), cut 64" long each
1	length of RG-58/U, about 36" long
1	suitable length of RG-331/U (½" alumifoam "hardline") feedline
8	PL-259 UHF plugs, silver-plated (Amphenol 83-1SP)
1	Phelps-Dodge #66-654 UHF hardline connector
1	Phelps-Dodge #66-656 UHF hardline connector
5	SO239 UHF receptacles (Amphenol 83-1R)
1	Cinch Jones P304CCT, 4-conductor cable plug
1	Cinch Jones S304CCT, 4-conductor cable receptacle
1	Cinch Jones P304RP, 4-conductor recessed panel plug
1	Cinch Jones S304AB, 4-conductor flush panel receptacle
1	Bud AU-1029 utility cabinet
1	Bud SC-2133 cowl minibox
3	Allied KN105-1C-12D relays (SPDT, 12 V dc/150-Ohm coil, 10-A contact rating)
1	Stancor P8384 transformer (12.6 V c-t, 1 A)
1	Semtech SBR1 bridge rectifier (100 piv/leg, 1.5 A dc)
1	Centralab PA2006 rotary switch (3 pole, 4 position)
1	Allied #652-0503 SPST miniature toggle switch
1	Mallory 25X100B electrolytic capacitor (100 μF, 25 W V dc)

Miscellaneous: #4-40 and #6-32 hardware and solder lugs; knob for rotary switch; pilot lamp assembly, 120 V ac; zip-cord/ac line plug assembly; GE silicone bathtub caulk, waterproof; terminal strips; grommet for ac line cord; hookup wire.

Note: None of the parts listed is particularly critical, and each may be substituted for as desired. However, I strongly recommend the following:

● Use only Amphenol rf connectors. Cheap substitutes may work at low frequencies, but at 146 MHz, PL-259s are marginal performers unless they're good ones and assembled properly.

● Use Cinch Jones 4-conductor plugs and sockets. They're easier to work with and are far more durable than cheap substitutes.

● Use Belden 8214, Times FM-8, or other high-quality, foam-dielectric cable for antenna/relay-box interconnects. Avoid CB-grade coax.

● If you cannot find truly high-quality foam coax, use Belden 8237 or any brand MIL-Spec RG-8/U cable (be sure the cable says "MIL" or "MIL-C-17" right on it) and change the length from 64" each to 53" each.

● *Do* use hardline as transmission line if your run to the shack is more than 50 feet. The difference in loss at 146 MHz is well worth the slightly higher cost. Why use a gain antenna system if that gain is thrown away in the feedline?

● The relays listed are somewhat critical. Avoid miniature and encapsulated relays; also avoid the plug-in type. Usually, the built-in interconnect leads are far too long for rf work, especially at VHF.

Calvin McCarthy VE3LMP
98 Windsor Street
Thunder Bay, Ontario
Canada P7B 1T7

Taming the 2-Meter Linear

It lives in the forests of spurious oscillations and answers to the call of the correct bias. Catch one for yourself.

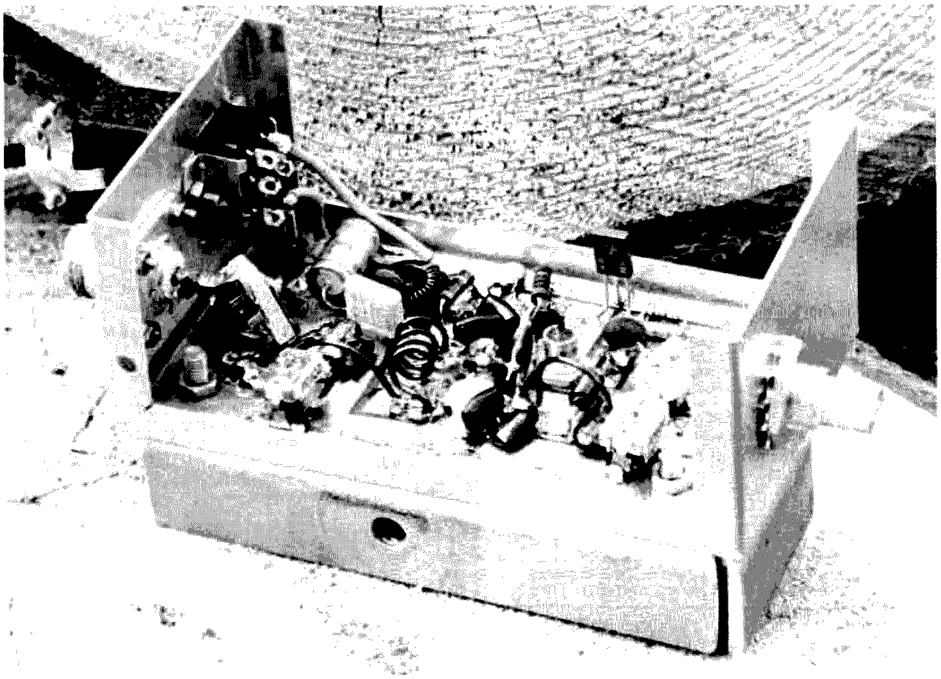
Class C amplifiers for the two-meter band are a "dime a dozen," with commercial models, kits, and schematics available from a good number of suppliers. Linear amplifiers are another story. Their design and construction is all black magic, and manufacturers are the only wizards in on the mystery. With a little sleuthing, I found that Motorola would sponsor my initiation into this exclusive cult, allowing me to build an amplifier to boost the output of my 2-meter OSCAR station from 2.5 Watts to 20 Watts.

In order to linearize a solid-state rf power amplifier, you must solve two problems. First, you must bias the transistor into the linear region while supplying a substantial amount of varying base current. Secondly, you must tame any spurious oscillations generated by the high-gain transistor used.

First, the biasing problem will be faced. A small-signal transistor amplifier is usually biased with a voltage-dividing network such as that shown in Fig. 1(a). The current flowing through the network resistors is set to be about ten times the current needed by the base. With our amplifier needing from 10 mA to 100 mA of base current at any time, this circuit would not be practical. As well, the bias voltage must be held at a constant stiff value for all values of base current, which is not possible with a resistive voltage-divider network.

An alternate solution to this biasing problem, which satisfies the need for a constant bias voltage while supplying varying currents, is the solid-state voltage regulator. Either the shunt regulator of Fig. 1(b), where the total bias supply current is greater than the maximum base current and the surplus current is shunted to ground by the reference diode, or the series pass regulator of Fig. 1(c) can be used. The series regulator reduces the current which must flow through the reference diode by i_{base}/hfe, and the total bias current used becomes virtually the base current needed at each instant. The bias voltage is set by the forward voltage drop of the diode reference which is approximately 0.6 volts. The series regulator bias is set by two forward-biased diodes in series, the second diode voltage drop compensating for the base-emitter junction drop of the series pass transistor so that the bias supply voltage output will equal only one PN junction voltage drop.

Now for a very important point! As a transistor warms, its base will draw more current, which increases collector current, which warms the transistor more, and this will continue until the component self-destructs. To offset this, the base bias voltage must be reduced as the transistor warms. By mounting D_{ref} as



MRF 2-meter linear amplifier.

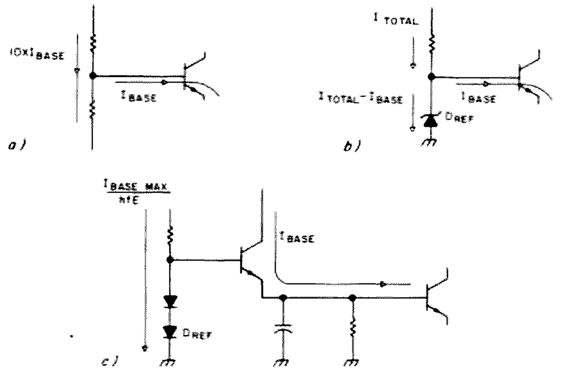


Fig. 1. Bias possibilities. (a) Voltage divider arrangement. (b) Zener diode stabilized. (c) Pass transistor circuit.

close to the rf transistor as possible to provide thermal contact, the diode junction voltage will *decrease* as the diode warms, neutralizing the base-emitter junction change of the rf transistor and thus keeping the base current under control. Remember! Attach the reference diode so that it will be warmed by the rf power transistor. Either physically attach it to the transistor body or to the heat sink as close to the transistor as possible. *Do not* expect the reference diode to thermally track if the thermal path is broken by air.

Low-frequency oscillations also are a problem. My amplifier first oscillated in the HF band because at these frequencies the transistor has very high gain. Bypassing the collector current feed did not tame these troublsome responses, so I took the brute-force method and fed back the collector signals to the base through a feedback network. The rf choke is a virtual short for the oscillations but an open circuit for the desired VHF response. The capacitor is a virtual short for the undesired oscillation but an open circuit for the collector supply. This network was placed between the collector and base with very short leads and the unwanted oscillations were completely suppressed.

The amplifier which I built (Fig. 2) is a modified version of the class C amplifier described by W4MNW in the November, 1977, issue of *73 Magazine*. I lifted RFC1 from ground, added bypass capacitors to the lifted end so the rf input would continue to see a ground, then connected the base bias supply to RFC1. The low-frequency feedback network was added to stabilize the amplifier and the linear amplifier was a reality. It would appear to be quite possible to linearize many of the class C amplifiers now in FM and CW use in the same way.

The testing of this amplifier was done with a regulated and current-limited power supply. This saved the transistor from destruction before I had tamed the low-frequency oscillations. The transistor is rated for a collector current of four Amperes, but I set the supply to limit current to a maximum of one Ampere until I was satisfied that the amplifier would not hurt itself.

Low-frequency oscillations manifest themselves by a sudden jump in collector current and corresponding drop in supply voltage. The first time this happened I thought I had destroyed the transistor, but the power supply protection had saved it. I was able to continue my study of the problem and a wideband oscilloscope revealed a pulse-type response on the collector output. This was suppressed by the feedback network shown in the schematic.

I made an interesting observation about amplifier efficiency while tuning the amplifier. There is a particular collector current needed to give a particular output power—not so collector voltage. Thus 0.5 Watts input will become 4 Watts output at 2 Amperes collector current whether the collector voltage is 5 or 12 volts. Under the same conditions, the dc input power changes from 10 Watts to 24 Watts. For maximum efficiency, it seems that the amplifier should be operated at the maximum linear power output possible for the applied collector voltage, or if it is desired to operate the amplifier at reduced power, the collector voltage should be re-

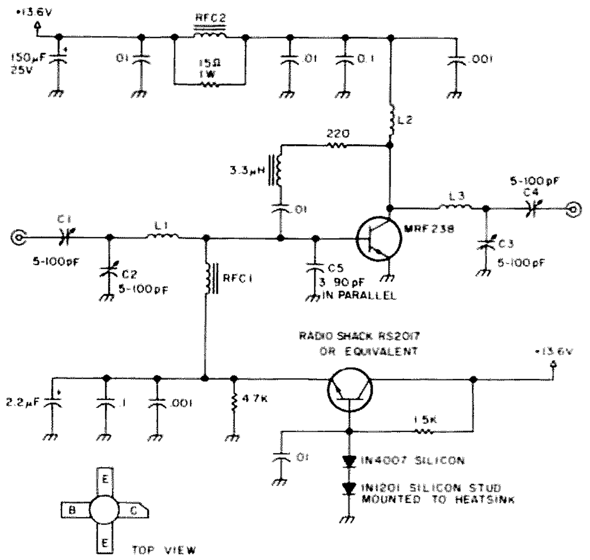


Fig. 2. Amplifier schematic.

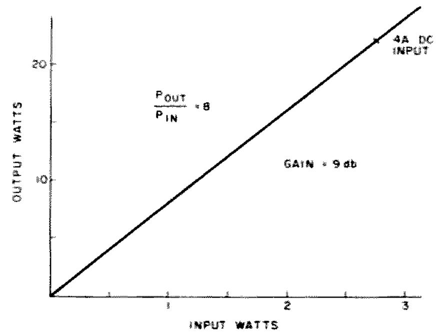


Fig. 3. Amplifier linearity.

Coil Construction Details

RFC1 10 turns #22 on 270-Ohm, ½-Watt resistor
RFC2 13 turns #22 on T50-6 toroidal core
L1 ½ turn #16, approx. 1½"
L2 4 turns #16, 1/4" i.d.
L3 Curved wire, #16, 1-1/4" long

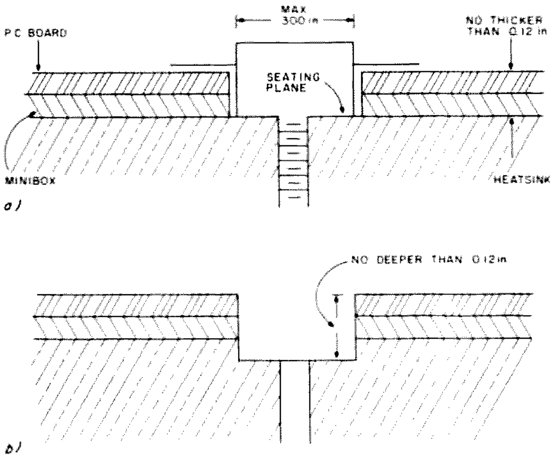


Fig. 4. MRF238 mounting details.

duced. Linear operation at 4-Ampere dc input is shown in Fig. 3.

The amplifier was built in a 5¼″ × 3″ × 2½″ minibox on double-sided epoxy glass PC board. The circuit lands were etched, but islands of PC board epoxied to the ground plane would serve as well. Be very certain that the capacitors that make up C5 are soldered with *short* leads as close to the transistor body as possible. Connect the ground plane on both sides of the board with eyelets or wire running through the board and solder on each side. A heat sink is necessary. My heat sink has 35 square inches of radiating area and it seems to be just satisfactory. A larger one is recommended.

The mounting of the MRF238 is very critical (see Fig. 4). Careless technique will result in a destroyed transistor if stress is placed on the leads. Mount the transistor seating plane with very good thermal contact to the heat sink. The thickness of the case metal and the PC board must not be greater than .120 inch. If it is, the transistor leads will be forced up, putting a strain on the transistor cap. On heating, the bonding material will fail and you will be out buying a new expensive transistor. If the PC board and case thickness together is much less than .120 inch, you may want to mill out the heat sink as in Fig. 4(b) so the transistor leads will not be bent down when soldered to the PC board. *Do not* solder the leads before tightening the stud mounting nut. *Do not* hold the transistor leads while tightening the nut. *Do* hold the transistor securely by the wrench flat on the end of the stud while tightening the nut. Only after the mounting nut has been tightened carefully may you solder the leads to the board.

The MRF238 Motorola transistor is available from Ramsey Electronics and Semiconductor Surplus, both *73* advertisers. ■

References

1. Charles F. Clark AF8Z, "Solid-State Linear Amplifiers," *Ham Radio*, January, 1980, p. 48.
2. D.J. Lynch W4MNW, "Build a 2-Meter Power Amp," *73 Magazine*, November, 1977, p. 96.
3. Motorola Semiconductor Products, Inc., Box 20912, Phoenix AZ 85036:
AN546—Solid-state linear amplifier design.
AN555—Mounting stripline-opposed emitter (SOE) transistors.
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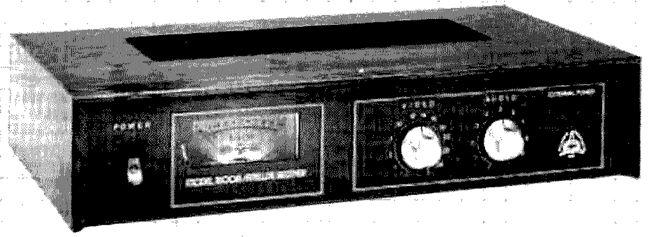

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The Frugal Floppy Bazooka

This 2-meter antenna coils up into a small package, but it shoots a straight signal.

Another 2-meter antenna for your handie-talkie? You bet! When you combine low cost, portability, and reasonable gain as this antenna does, it is well worth covering the subject again. The design of this gain vertical was inspired by the excellent article by W1IS in the May, 1981, issue of *73 Magazine*. One of the current-distribution charts reminded me of the "bazooka" coax-to-dipole decoupling scheme which uses a grounded sleeve in place of radials, and the "floppy bazooka" was born.

Construction

My prototype antenna was assembled from RG-58A/U (with the stranded center conductor), which is (a) very flexible and (b) what I had on hand. I started with about 20 feet of the cable and terminated one end with a BNC male to match the connector on my HT. The next step is to remove approximately 34 inches of the outer cover and braid from the loose end of the coax, leaving about ¼ inch of braid exposed and the center conductor intact.

Why 34 inches if a quarter wave at 146 MHz is about 19 inches? Because I had to compress the braid slightly, increasing its diameter and decreasing its length, to slide it over the feedline. After doing so, I *carefully* soldered the ¼ inch of exposed braid on the feedline to the braid sleeve, taking care to not melt the center conductor dielectric. I provided as much coverage as possible with the braid splice.

I covered the splice with heat-shrink tubing, although electrician's tape will do fine. Pull the braid down snug on the feedline and *now* measure the 19½ inches you expected, from the splice just covered to the lower end of the sleeve. I found this dimension to be very noncritical, but the shortening with compression varied from sample to sample of coax, which is why I started with 34 inches! After cutting the sleeve to length, I secured the end to the feedline in the same way I covered the splice.

Testing

The *first* test I made was with an ohmmeter: checking at the BNC end for a potential short. Don't trust the ability to receive a full-quieting signal as proof of proper wiring—I live less than a mile from a local repeater, which breaks the squelch on my HT fine without any antenna plugged in at all!

After avoiding the "smoke test," it was time to prune that 34-inch center conductor to resonance. My first cut was to 20½ inches, and out came the swr bridge. One quarter of an inch at a time, I marched up the band—on low power and avoiding repeater inputs, of course. I found that the antenna would give better than a 2:1 swr over about a 1.5-MHz range,

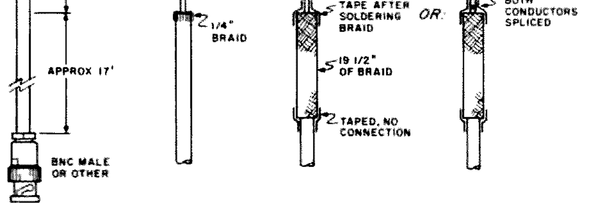

Fig. 1. The floppy bazooka.

with 19¼ inches hitting 146 MHz on the nose.

I wasn't thrilled with that bandwidth, so I opted for a simple modification: a "thicker" radiator. I started with a 20-inch piece of RG-174/U, with the center conductor and braid shorted together where they are spliced to the center conductor of the RG-58A/U and shrink tubing again covering the evidence. After the same pruning procedure, this came much closer to my expectations, covering the entire 144–148-MHz band with a worst-case swr of 1.8:1.

Use

I attached some 1/8-inch nylon cord to the top of the center conductor with two small wire ties, and the installation problem of a non-self-supporting antenna was solved. The antenna can now be suspended almost anywhere. Bear in mind that it has a very low angle of radiation and must be kept quite vertical to take advantage of its gain characteristics. I chose the 17-foot length of feedline as a reasonable trade-off between losses and the ability to put the antenna in better (higher) places. The antenna and nylon "mount" bundle neatly into a tiny package hardly larger than my HT, making it an ideal traveler's antenna.

My comparison of the floppy bazooka's performance to other antennas was not rigorous, but very satisfying. It significantly outperformed my ¼-wave ground plane in fixed-station use and incredibly outperformed the rubber ducky.

The floppy bazooka is cheap, easy to build, and works very well. It also lends itself well to modification and experimentation. Try it! ■

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Taking It Higher

Raising a repeater's antenna is the way to wider coverage, right? Wrong.

When it comes to repeaters, higher is better! Right?

Not necessarily. It depends on what you want to accomplish.

Sooner or later, every repeater organization in the country gets the urge to move the repeater antenna up to twice as high as it already is, to improve coverage. Most of the time, it does improve. Every once in a while, though, some unexpected glitches result.

The Tallahassee Amateur Radio Society went through the process of moving from a downtown site with an antenna elevation of about 350 feet to a new commercial tower near the edge of town with an elevation of 800 feet above mean sea level (MSL). Sure enough, coverage was considerably extended. But sure enough, there were several surprising developments. What happened, and why, makes an interesting case study.

We knew from experience that the downtown site gave us an effective coverage range of about thirty miles in all directions over fairly mild terrain. South of the city, the coastal plain stretches away to the Gulf of Mexico, flat as a pizza, with an elevation of about 50 feet above MSL. But right in the middle of the city the terrain rises abruptly at the limestone scarp which, a few million years ago, was the coastline when sea levels were higher than now. These hills rise to elevations of 150 to 230 feet, with an average elevation of perhaps 175 to 200 feet above MSL on any bearing in the northern semicircle centered on Tallahassee.

What would happen when we moved from 350 feet to 800 feet? Would we be able to work 75 miles? 100 miles, as some members predicted?

The visual line-of-sight distance from an antenna to the horizon is expressed by the formula $R=\sqrt{2H}$, where R is the range (or radius) in miles and H is the height in feet of the antenna above average terrain. It is the basis, in commercial antenna engineering, for computer calculations of the antenna's performance, cranking in corrections for such things as absorption of radio energy by foliage and buildings, shadowing by hills, and the fact that radio signals can nearly always be heard beyond the visual horizon.

Without benefit of a computer, I modified the formula based on empirical observations of repeater performance in actual operation. The formula is intended to be an approximation, not a precise prediction. I cranked in a number of assumptions about ham radio which do not apply to commercial and public safety services.

For example, most amateurs are willing to settle for less than 100% reliability over a given path. And most of us are willing to accept a noisy signal if it is still readable. The modified formula turned out to be: $R=\sqrt{2.5H}$.

Applied to our downtown antenna site, it predicted a contour which agreed well with our experience with the repeater. Here it must be said that a number of other assumptions also must be made. For example, we assume that most mobiles will use about 15 Watts output to a quarter-wave whip, that they will be in motion, that they will have little or no ignition interference, that they have receivers with a sensitivity of half a microvolt or less for 20 dB of quieting, and that the ambient acoustical noise in the mobile will be fairly high.

The critical parameter was defined as the point at which "practical communication" through the repeater becomes possible between a mobile at the fringe of the coverage and a mobile or fixed station located within the full-quieting contour of the repeater. In effect, this boils down to: "Can I use the repeater to get useful information on

road directions or weather conditions?"

Once the repeater was installed in the new location, I began collecting data by the simple expedient of working mobiles as they passed through the area and noting their positions when effective practical communication became impossible. Each such observation was noted on a large scale map (half an inch per mile) as a big red dot. Eventually, each of the roads into town became plastered with dots which sometimes covered several miles of road. These "smeared" observation points resulted from the variations between observations. One mobile might be using 25 Watts to a 5/8-wave whip. The next might be running only 10 Watts to a quarter wave. Another might suffer severe ignition noise on reception or his receiver might be "hot" or slightly "deaf." Propagation conditions might exert some influence from day to day. The final point on the road was chosen at about the middle of the "smear."

The results of the tests were plotted on a map, with the observation points on the highways being connected by a smoothed line. Circles, also centered on the repeater site, showed the 40- and 50-mile radii. The formula predicted an effective working range of 44 miles, disregarding terrain effects.

The interesting distortions of the working contour are almost entirely the result of terrain. A peculiar flattening in the northwest quadrant results from a ridge of hills along the eastern bank of the Apalachicola River. Mobile signals almost "wink out" when they drop over the crest of the hill into the river flood plain. The southern semicircle bulges outward because the terrain in that sector is substantially lower than Tallahassee and is dead flat coastal plain. The Gulf coast itself cuts off the bottom of what would be a rough circle. No observations were taken from boats in the Gulf. I suspect that the contour would bulge outward in that sector because of the high conductivity of the salt-water ground.

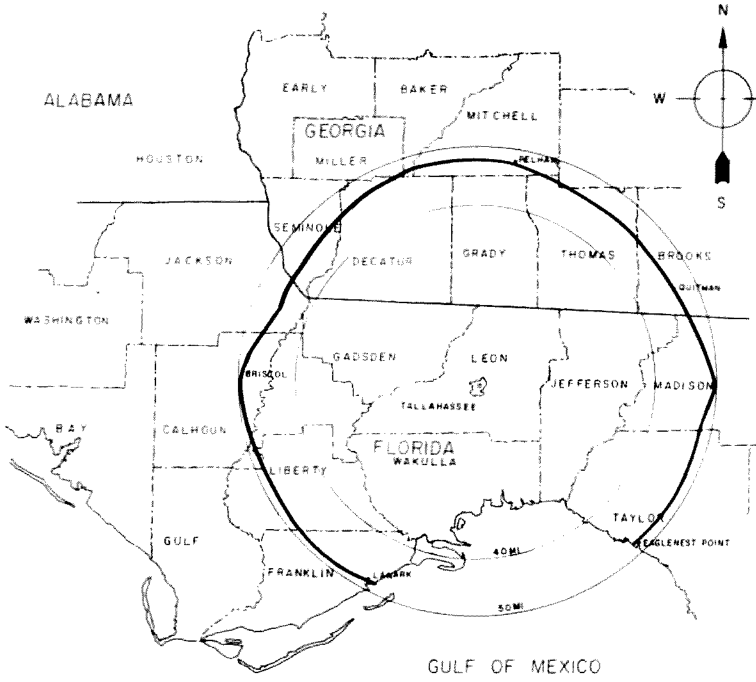

Fig. 1.

One unexpected side effect is that the repeater signal in the city of Tallahassee is not strong enough to quiet fully most mobile receivers. A possible reason is that the antenna is designed to provide some gain and it does this by taking energy away from the upper and lower hemispheres of the radiation pattern and concentrating it around the "equator." The antenna is so high that most of the city lies in the deprived cone directly below it. The favored lobe of radiation widens gradually as it goes away from the tower, and at 10 miles or so the signal at ground level is quite strong.

Another unexpected problem arose in early work at the new site. We tried to use the top antenna at 800 feet for receiving and a side-mounted antenna at 485 feet for transmitting. Reflections and other effects resulting from the tower, guy cables, and other factors produced a radiation pattern which was pulled in strongly to the west and had a powerful lobe to the northeast with an effective range of nearly one hundred miles in the favored direction. We solved the problem by using the top omni antenna for both transmit and receive.

The repeater is on 146.31/.91 MHz, and in this area we have very little, if any, co-channel interference unless there's a strong band opening. For a few days, we experimented with a 146.16/.76 machine on that tower. The results illustrate one of the problems which go along with great height. Mobiles trying to bring up the Valdosta, Georgia, repeater on .16/.76 eighty miles away also brought up the Tallahasee repeater. And because of the strong northeast lobe, our signal was nearly as strong in Valdosta as the Valdosta signal was!

In urban areas, it is entirely possible to cover so large a ham population that the traffic load on a repeater becomes unacceptably high unless access is restricted in some way. When contemplating a repeater on a tower at 2,000 or 3,000 feet above average terrain, it may be desirable to choose a site considerably distant from any expected concentration of ham stations. Otherwise, the area deprived of signal by the antenna gain effect may become a real problem. The effect is greater on UHF than on VHF.

The Stone Mountain repeater near Atlanta, for example, covers Atlanta and most of the surrounding country like a blanket, but it is located about twenty miles east of the city itself. Repeaters located in the Great Smoky Mountains of Kentucky, Tennessee, and northern Georgia cover enormous ranges in their favored directions (where

mountainous terrain doesn't block the signals) and they serve a largely rural population without the dense concentration of stations which might cause problems in, say, New York City, Chicago, or Los Angeles.

It should be kept in mind, when trying to apply our rule-of-thumb range formula to other locations, that terrain is often a much bigger factor than it is in Tallahassee. The formula will give reasonably accurate results only when it is applied to one particular radius using the "average terrain elevation" along that particular line. A repeater in Iowa may well have an almost circular pattern. A repeater located in California or West Virginia is likely to be a totally different matter. The formula is not applicable directly to repeaters on bands other than two meters because terrain losses will not be the same. However, on any band, range will vary in direct proportion to the square root of the height of the antenna, and it should not be difficult to work out a new H multiplier which would give reasonably accurate results on, say, 50, 220, or 450 MHz.

Clubs which put up repeaters with wide coverage areas should be prepared to welcome and to serve many itinerant mobiles travelling through the area who may frequently be more interested in working each other than in working locals. Repeater groups that want to communicate among themselves for rag-chew, emergency, or other purely local communications purposes should give serious consideration to using a lower antenna site or a closed repeater operation using some form of restricted access. ■

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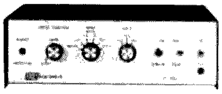

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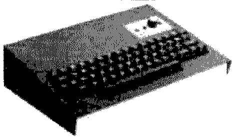

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The system I developed allows me to dial up any one of four channels in my two-meter radio. This is done using a standard dial telephone with a minor modification for push-to-talk operation. The telephone is connected to a controller via a single pair of wires that can be several hundred feet long. Several phones may be connected to the line, although only one may be used at a time. Of course, the telephone may be moved about by using jacks.

I'll review a little of telephone basics, go into the development of the system, talk about construction details and adjustments, and offer some afterthoughts that you may want to include in your version. Successful duplication of the ideas presented depends on how resourceful you are, as some of the relays and transformers may be difficult to find.

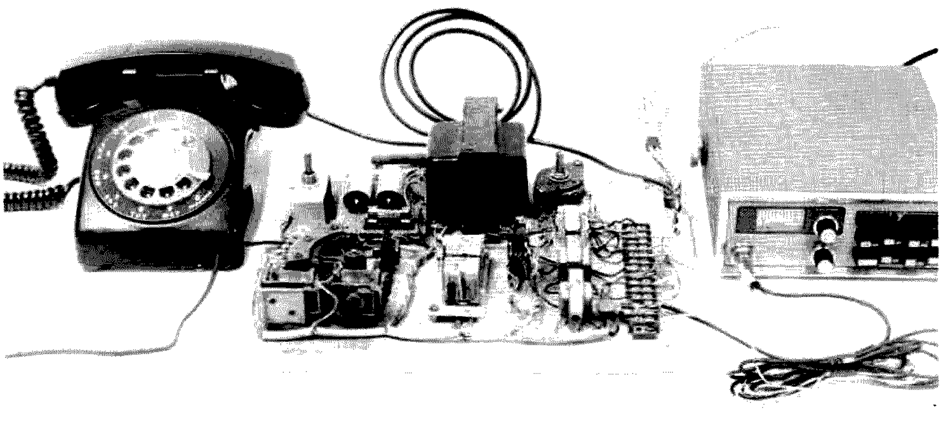

Photo A. Overall view of the remote two-meter dial-up system. The telephone can be located several hundred feet away from the radio and its controller.

Basic Terminology

We all use the telephone every day. It seems to be a simple enough device, and on close inspection, it is. Fig. 1 shows the basic circuit from the telephone to the central office. The two wires that connect these two locations are a twisted, balanced pair with a typical characteristic impedance of 600 Ohms. Longitudinal balance describes how closely each conductor matches the other along the

route. This becomes increasingly important the longer the circuit becomes. The better the longitudinal balance, the less interference occurs from outside sources such as other telephone circuits in the same cable and parallel power conductors.

The telephone set shown in Fig. 1 is a simplified circuit. An actual type-500 phone as shown in Photo C has additional circuits to match the impedance of the set to the line and has additional contacts on the dial and the switch hook to short out the earphone when dialing or when the receiver is on hook. This eliminates annoying pops in the earphone.

Direct current continuity is a requirement of the circuit for signaling and to provide a dc bias current for the carbon microphone in the telephone. When you lift the telephone "off hook," the dc circuit is completed with current flowing through the microphone. When you turn the dial clockwise to the stop, a spring is wound up in the dial. When the dial is released, the spring returns the dial and a set of contacts opens and closes once for each digit dialed at a rate of 10 pulses per second. Many modern central offices can respond to 20 pulses per second, so some phones are so equipped. A tone-dial phone still requires a dc continuous circuit to tell the central office when it is off hook and to have dc bias for the carbon microphone and tone generating circuits.

At the central end of the circuit, note the one-to-one ratio transformer with a split winding on one side. This transformer allows the insertion of dc current and the picking off of the control signals while maintaining the circuit balance to ground. At the same time, voice and tone signaling (if applicable) are coupled through to the other side of the transformer. The capacitor shunting the power supply and relay coil on the line side of the transformer bypasses audio frequencies.

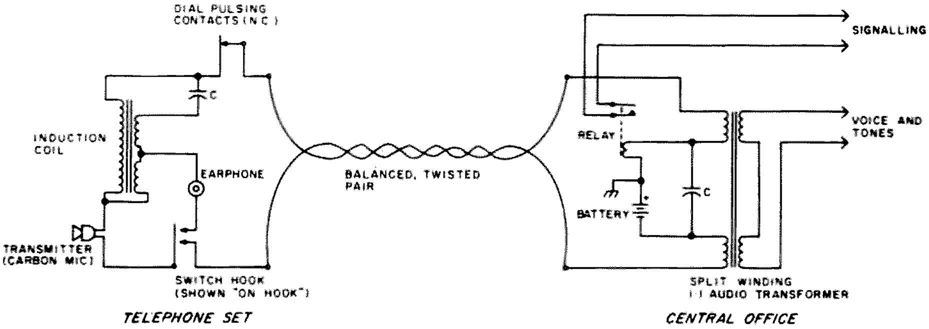

Fig. 1. Basic telephone circuit. Note that dc current flows from the central office battery through the carbon microphone—but only when the switch is "off hook."

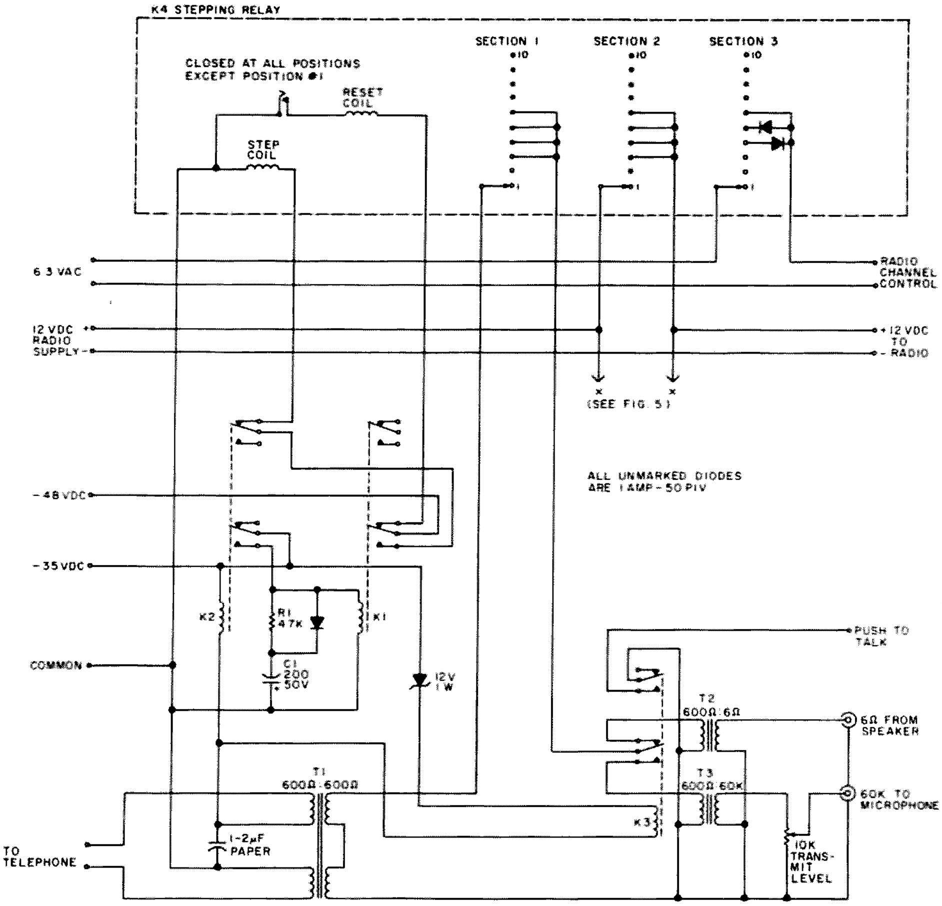

Fig. 2. Schematic diagram of the dial-up two-meter remote controller.

The circuit shown in Fig. 1 is the basis of my two-meter dial-up remote controller. I won't go further into the operation of the central office, but if anyone is interested in further study in this area, *Basic Telephone Switching Systems* by David Talley (Hayden Book Company, New York NY) makes good reading.

Development of the Dial-Up Remote

There are three control functions that must be provided in the two-meter dial-up system: the off-hook condition, dial pulses, and push-to-talk function. These three functions are provided by relays K1, K2, and K3, respectively, in Fig. 2. The telephone set itself must be modified to provide push-to-talk operation. More about this later.

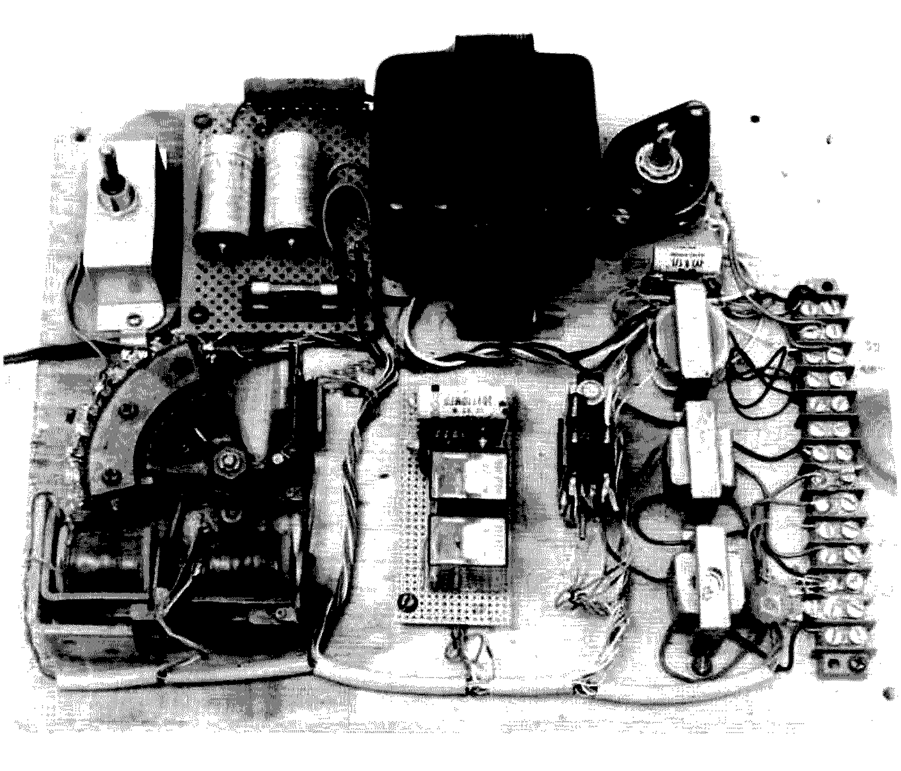

Photo B. The controller with power supply at the rear, stepping relay at the left, K1, K2, and K3 in the middle, and the audio transformers next to the terminal strip on the right.

When the telephone receiver is lifted off hook, the dc circuit is completed from the 35-volt source to K2 and to the series combination of the 12-volt zener diode and K3. Contacts on K2 apply 35 volts to K1 and charge C1 through R1. R1 is necessary to prevent contact arcing on K2. Now that K1 is picked up, the 48-volt source is removed from the reset coil on the stepping relay and applied to contacts on K2 which are connected to the stepping coil. A separate 48-volt source was necessary because of the particular stepping relay that I had available.

What happens now if the dc loop to the telephone set is broken for a fraction of a second by dialing a "1"? Relay K2 drops out for a brief period and picks up again when the dc loop is again completed. This removes the 35-volt source from K1 briefly, but the charge on C1 holds K1 closed through the diode. The 48-volt supply is therefore maintained to the contacts on K2 which close for the brief time that K2 drops out. This applies a single pulse of 48 volts to the stepping coil, advancing the switches one step to position two.

If you were to hang up at this time, relay K2 would immediately drop out. Relay K1 would remain energized for about one-half second because of the charge on C1. When K1 finally drops out, the 48-volt supply is applied to the reset coil. Because the switches are not in position one, the reset contacts on the stepping relay are closed. The reset coil will therefore reset the switches to position one, at which point the reset contacts on the stepping relay again would be open.

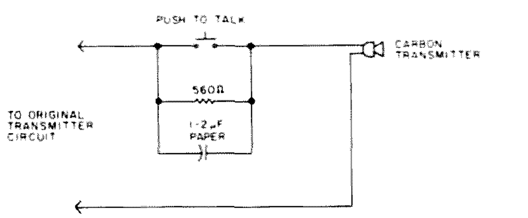

Fig. 3. Telephone set modification for push-to-talk operation.

If we now lift the receiver and dial, for example, a three, the switches will advance to position four and stay there until we hang up again. Note that the stepping and reset coils never have voltage applied for any length of time. They usually are rated for intermittent duty only. Note also that dialing 12 or 21 has the same effect as dialing a three.

Fig. 3 shows the modification for push-to-tak operation. The parallel combination of the pushbutton, resistor, and capacitor is inserted in series with the carbon microphone or at any point in the current loop, such as the line coming into the telephone. When the push-to-talk button in the handset is pressed, the 560-Ohm resistor is shorted, resulting in a higher voltage across K2 and the series combination of K3 and the zener diode. A zener diode was used in series with K3 rather than a resistor so all of the voltage difference brought about by pushing the push-to-talk button would appear across the relay. The capacitor shunts the resistor for voice frequencies.

Relay K3 must be selected carefully. It must have a drop-out voltage not much less than its pick-up voltage. The unit I used has a 12-volt coil and is a plug-in type from an old IBM keypunch machine. Most 12-volt relays will pick up at about 10 volts but many will not drop out once picked up until the voltage is less than three or four volts. The variable resistor in the power supply (Fig. 5) is adjusted for proper push-to-talk operation. You may want to experiment with electronic circuits to sense the push-to-talk voltage change and which would, in turn, drive the push-to-talk relay. Another alternative would be to run a separate pair of wires for the push-to-talk button.

The push-to-talk relay, K3, grounds the push-to-talk line to the radio and switches the 600-Ohm audio from the split-winding transformer, T1, between the radio microphone input and speaker output. Impedance matching is required on both of these circuits. I used some small, 120-to-12-volt (10:1 ratio) filament

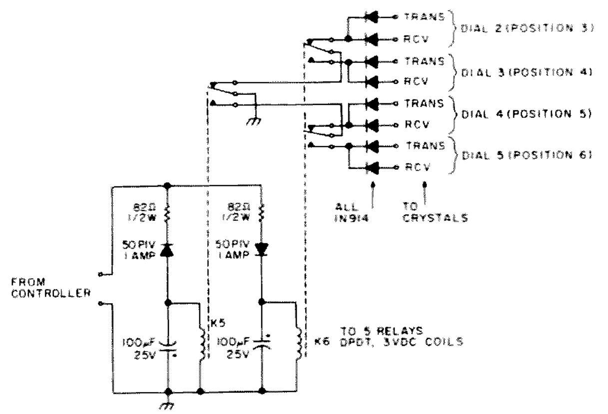

Fig. 4. Channel-change circuit located in the radio.

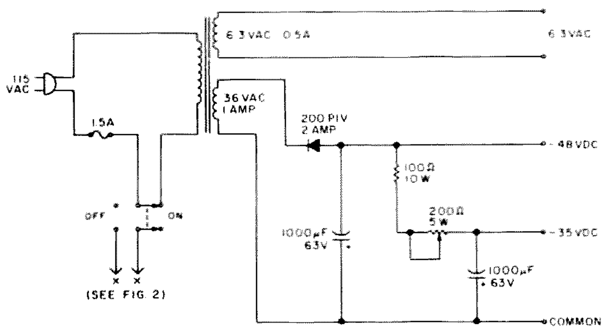

Fig. 5. Power supply schematic diagram.

transformers from my junk box.

The stepping relay that I used has three switch sections. It is a C. P. Clare model A321033 that was salvaged from an electrical circuit recloser. One section is used to connect the telephone circuit to the radio. This allows me to dial up other devices on other positions of the stepping relay, such as a weather receiver. The second section turns on the power to the two-meter transceiver. The third section changes channels in the radio. Stepping relays are available from time to time from surplus outlets such as Fair Radio Sales, 1016 East Eureka Street, PO Box 1105, Lima OH 45802.

Fig. 4 shows the channel-change circuit. Two miniature relays are used to select the appropriate crystals in the Heath HW-202. The resistors in series with the relays are necessary because the relays I had available have 3-volt coils. Note that when the stepping relay is in position three, neither relay is energized. When in position four, K6 is picked up, when in position five, K5 is picked up, and when in position six, both relays are picked up.

In each case, a different pair of crystal switching diodes is grounded. I disconnected the radio switch grounds from the chassis ground and reconnected them to be grounded when neither relay is energized, position three. This allows me to select with the radio switches which channel will be selected when dialing a two. It also allows the radio channel switches to function normally when not connected to the controller or when the controller is switched off. The other three positions are connected to the crystals of the most commonly used channels.

The power supply, Fig. 5, is straightforward. A small amount of 6.3-volt ac power is required for the channel-changing circuit. The 36-volt secondary on the transformer gives about 48 to 50 volts dc for the stepping relay. It must be capable of supplying the intermittent current requirements of the stepping relay, about 1 Ampere in my case.

Dropping resistors are used to supply a lower voltage for operation of K1, K2, and K3. This voltage should be relatively hum free as it is also used to bias the carbon microphone. The dropping resistor is made variable to allow setting the push-to-talk operating point. Positive grounds are used as this is telephone system convention but it certainly isn't necessary. If negative grounds are desired, it is only necessary to reverse the polarity of C1, the diodes associated with K1 and K3, and, of course, the power supply capaci-

Photo C. Modified telephone set. Note the push-to-talk button in the handset and the resistor-capacitor combination mounted on the added terminal strip.

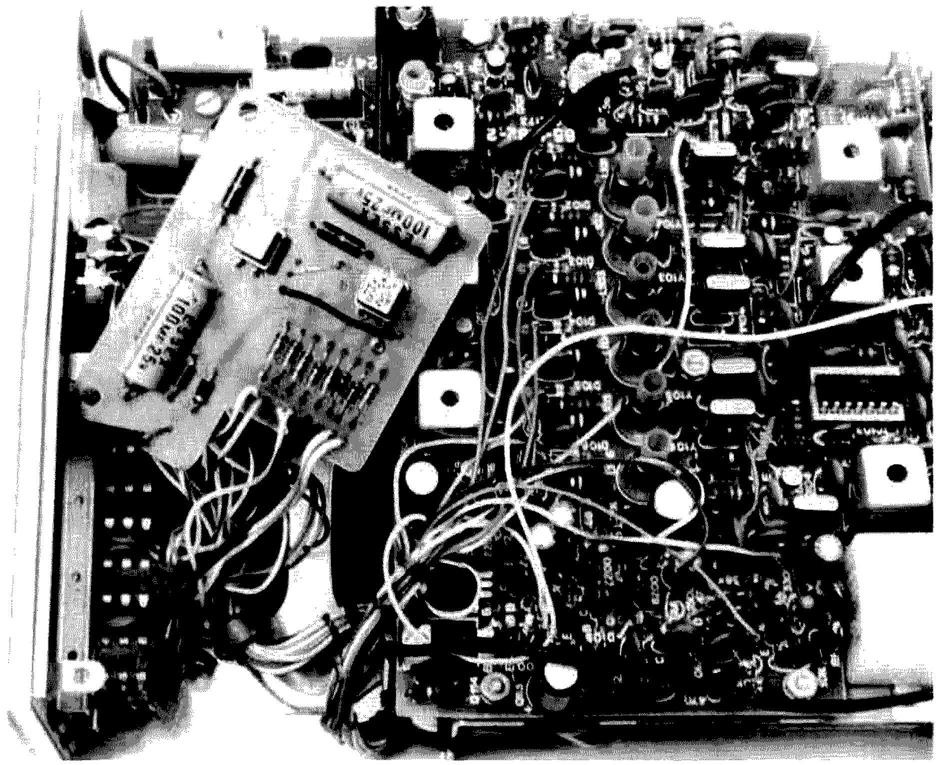

Photo D. Channel-change relay circuit board. The ungrounded side of the circuit pokes through the plastic filler where the burst encoder push-buttons would be located.

tors and diodes. Power supply requirements for other versions will probably be different depending on what relays the junk box and local surplus outlet may yield. Switch S1 turns on the power to the radio when switching the controller off so that the radio can be used in a normal fashion.

Construction

As can be seen by the photos, I mounted all components on a piece of wood. While this method of construction is simple and effective, it is not terribly attractive. I plan to reconstruct the unit in a 3″ × 10″ × 17″ chassis mounted on a 3½″ × 19″ relay rack panel. Layout is not critical.

Modification of the telephone consists of removing the bells to make room for a terminal strip on which to mount the added resistor and capacitor. See Photo C. The handset must be changed to a push-to-talk type (available from Gray-bar Supply, 345 Harrison Avenue, Boston MA 02118, and from Fair Radio Sales, previously mentioned). The resistor-capacitor-switch combination can be inserted anywhere in the dc current loop.

The channel-change relay circuit board (Photo D) was etched using a Radio Shack etch resist pen and etchant. The board is simple enough that no fancy techniques are required. Foil layout will vary depending on your radio and the relays you can find. The ungrounded side of the channel-change circuit clips to the wire poking through the plastic filler where the burst encoder would go. This can be seen in Photo A.

Cables between the controller and the radio should be only a few feet long because of the high-impedance microphone circuit. Run a separate return lead for the channel-change circuit. Otherwise, the return current will flow on the microphone cable sheath resulting in transmitted hum.

The 12-volt dc leads should be fairly heavy to carry the 2.5 Amperes or so required on transmit. The push-to-talk lead goes into the microphone connector with the microphone cable. Make the speaker connection to the remote speaker outlet and throw the speaker switch on the radio.

The connection between the telephone and the controller is a single pair of telephone wires, typically number 19. I use about 150 feet of ordinary telephone wire, but distances up to one-half mile or possibly more should work. The limiting factor will probably be getting the push-to-talk relay to operate properly due to additional resistance of the phone line.

Adjustments and Operation

The first adjustment is to set the variable resistor in the 35-volt portion of the power supply. Start by setting it for maximum resistance. Then with the push-to-talk button on the telephone pressed, decrease the resistance until K3 picks up. Note the position of the resistor shaft. Releasing the button should cause the relay to drop out. If it doesn't, the push-to-talk relay you've selected must be replaced with a different type with a higher drop-out voltage. Assuming your relay did drop out, continue decreasing the resistance while pressing and releasing the button. Note the point where the relay will no longer drop out. Set the variable resistor midway between this point and the point where the relay first picked up.

Setting the transmit level can be done several ways. The ideal way would be to use a deviation meter. Barring that, connect a VTVM set for ac to the microphone connector terminals at the radio. Note the level range for normal speech while using the radio's microphone. Now disconnect the microphone and connect the controller. Adjust the transmit level on the controller for a similar range while speaking normally into the telephone microphone. A third possibility would be to use on-the-air reports.

Once you've gotten everything working, operation is very simple. Lift the telephone receiver and dial a two for the channel selected on the radio switches, a three, a four, or a five for the specific channels you've chosen. You'll need to set the volume for a comfortable level in the telephone receiver. By switching the power supply to the off position, reconnecting the microphone, and switching back to the internal speaker, the radio is restored to normal operation including the channel selector switches.

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Crystal Lake IL 60014

Improving God's IDer

Put more flexibility in the K2OAW circuit—and save the advantages of the original.

I have been a fan of Peter Stark's K2OAW IDer ever since the original design first graced these pages back in 1973. The simplicity of programming the thing, the low parts count requirement, and the lack of those hated Kernaugh maps made this, for me, the ideal IDer circuit. In the years since its first appearance, I have built maybe half a dozen of these circuits for my various repeaters and those of a few of my friends.[1]

With the advent of the FCC's decision to drop "R" calls for repeaters, regular

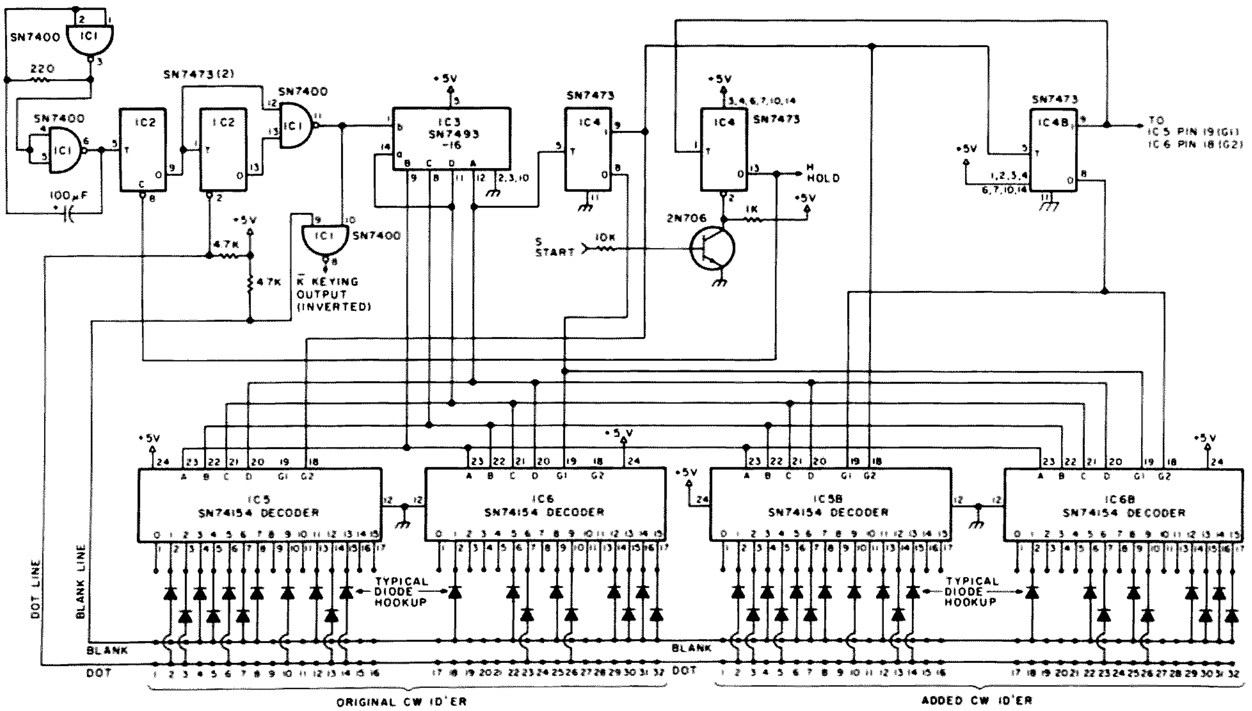

Fig. 1. K2OAW ID circuit update as it appeared in 73 in June, 1979.

amateur callsigns, followed by "RPT" or "/R", have generally necessitated more character space than the old K2OAW circuit could provide. So, a couple of years ago, Peter obliged the troops with an update of that original design which doubled, from 32 to 64 characters, the amount of information available for use in the IDer.[2]

However, though a lot of us need more than 32 characters for our ID, we don't always need *all* 64 of 'em, particularly those of us who believe that a repeater ID should say its legal piece and shut up. So, for those who wish to keep the ID process from continuing long after the CW is gone and to save a lot of diodes for the blank line, I hereby propose the "K2OAW IDer Update Update." As you will see, the improvements cover a lot more than what I've talked about so far.

Fig. 1 is the K2OAW ID circuit update as it appeared in the June, 1979, *73*. Peter added just 3 ICs, a 7473 (IC4B), and two 74154s (IC5B and IC6B) to accomplish the doubling of capacity. I changed the "ID hold" half of the original 7473 IC4B to a 74C76 (C? Yeah. Read on.), now called Z11A, and added one more IC, Z8, a 74C02 quad NOR gate. A 4001 would work just as well. To top things off, IC1A and IC1B, which comprised the clock oscillator in the original K2OAW circuit and its update, were scrubbed in favor of one half of an NE556 timer chip, running in the astable mode, with the other half being used for the ID audio oscillator. More on this later.

Fig. 2 shows how the two IC changes were implemented in the circuit. At the point in the ID where a stop bit is desired, two diodes are run to the appropriate pin on the 74C154 matrix, with one diode further connected to the dot line and the other attached to the blank line. The inputs of one gate of the 74C02 (Z8B) are connected to the dot and blank lines. This gate actually functions as a negative logic AND gate. When this aforementioned stop pin pulls both lines low together, the output of Z8B goes high.

This output is sent to two places, the "zero set" pins of Z3, which heretofore were grounded, and an inverter made from Z8A. Bringing the zero set pins on Z3 high sets all of its BCD outputs low. Grounding them allows the IC to operate normally.

The output of inverter Z8A feeds the "set" input on one half of the 74C76, Z11. A momentary low on this pin drives the $\overline{Q}$ output (also known as the ID hold line) low, halting the ID process in its tracks.

Z7A, half of the NE556, replaced IC1A and IC1B in the old circuit because the 556 is a much more reliable circuit, in my experience. The other half of the 556 is used in the astable mode as the ID tone generator.

IC1A and IC1B are not wasted, however. IC1B, now Z1B, is used to replace Q1, a 2N706 from the original ID circuit. It is connected as an inverter between the start line and the clear input of the 74C76. IC1A, now Z1A, is also used as an inverter, the input

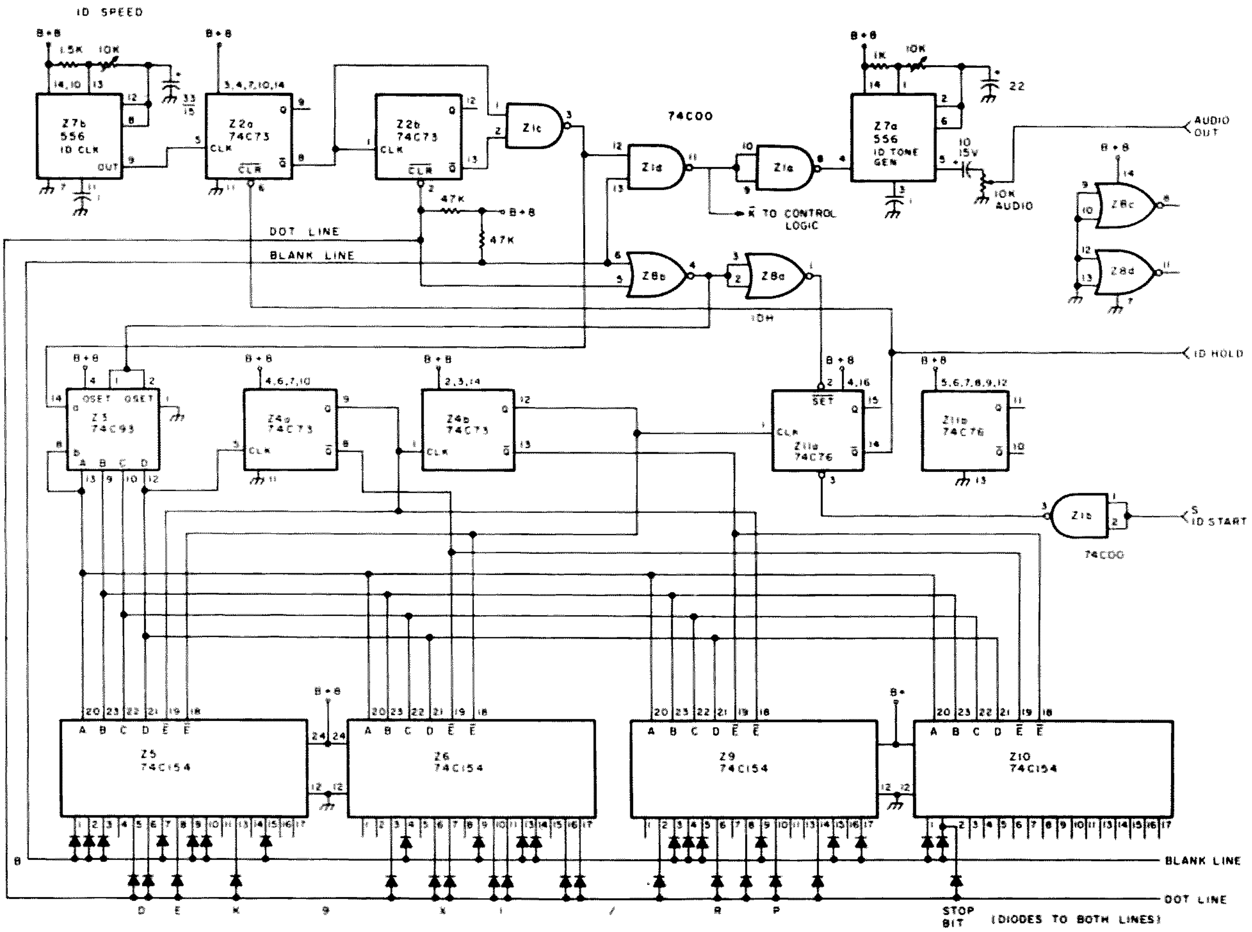

Fig. 2. The K2OAW update update.

connected to the $\overline{K}$ (keying) line, and the output connected to the reset pin of Z7B, keying the tone for the ID. The $\overline{K}$ line is still used for logic purposes.

The remaining two gates of Z8 are not used in this design and their inputs are grounded. Don't forget to tie all inputs of the other half of the 74C76 high. Leave the outputs floating.

Although this circuit adds 2 ICs to the design, it subtracts one transistor, and if your ID is short enough, you may be able to leave out Z10 as well, thus saving that expense. And you get a tone generator, a more reliable clock, and other improvements in the bargain.

About the 74C series: I switched all of my TTL to CMOS/TTL (by National Semiconductor) some time back. The savings in current is worth it, and the voltage requirement is not finicky like TTL. I use 8 volts on all my CMOS and timers.

One *caveat*: The 74C ICs used here are pin-for-pin replacements for their TTL counterparts *except* for the 74C93. If you're planning to retrofit an existing circuit and convert your 7493 to CMOS, you will have to rewire that part of the circuit.

With these modifications, I feel that the K2OAW IDer is the ultimate ID circuit. If you have one in use now and update to the circuit described here, I think you'll agree that the best has been made better. ■

References

1. Stark, "A Complete Repeater Control Circuit and ID," *73*, February and March, 1973.
2. Stark, "Update on the K2OAW ID Circuit," *73*, June, 1979.

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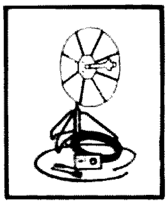

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The Bunesti Caper

The two British agents needed a power amp—fast. Could the American ham build one?

December 7, 1941, was a day of glory and achievement for the Japanese Empire because of the unbelievably effective attack upon military installations in Hawaii. In England, the long hoped-for involvement of America in the war now seemed assured. The "Day of Infamy," however, also brought a special sort of gloom and silence to one small segment of the American population—the amateur radio operators.

Photo A. The crew of Destiny Deb *prior to its final combat mission to Ploesti, Rumania. (The little guy on the left in the front row is W9PJF.)*

In the midwest that night, most of the ham bands were full of stations relaying the FCC announcement that all radio amateur activity was to cease immediately. It seemed that almost every ham in the country was trying to make as many contacts as possible that last night. I kept my 20-Watt AM rig (push-pull 45s modulated by 47s) going on 160 meters until well past midnight, but finally closed down when I got too sleepy to continue.

The next morning, I turned on my Howard 435A receiver and heard a couple of guys yakking away just as though the Pearl Harbor attack had never occurred. Naturally, I cranked up the rig and told them of the FCC notice. They claimed that my call was the first they had heard about it and that they thought their receivers

had been "desensitized by a storm." Of course, I didn't believe them for even a second, but that short chat on 8 December 1941 was to be my last ham QSO until World War II was over.

As a normal, healthy, high-school senior, I had no illusions about what the future held for me. I was caught up in the tide of rising national indignation at the treachery of the attack and looked forward to becoming a member of our armed forces. I hoped that my great interest and skimpy skills in radio might be useful. They were, of course, but there was a time still about 2-1/2 years away in my future when they were useful in a way I could never have imagined.

After graduation from high school, I found that the Army Air Corps was glad to have my services, but they insisted that I go to Miami Beach for basic training. This was to introduce me to the finer points of the military organization, to teach me discipline and respect for authority, to enable me to distinguish between my left foot and my right foot, and to educate me in a host of related subjects such as KP, policing the area, saluting, scrubbing the barracks, why all relationships with females are dangerous, etc.

During my third day at basic, an announcement was made that all personnel who knew Morse code were to report to the administrative office at 1300 hours. I reported as ordered and was given a short code test that was sent at about 10 wpm. I don't think that I missed a letter, and the next day I was on a troop train bound for the radio school at Sioux Falls, South Dakota. In my hands were records showing that I had completed basic training (?) and a promotion order making me a PFC! Those long hours practicing code in order to pass the ham exam had finally paid off, since I avoided many miserable hours of close-order drill.

The Air Corps radio operator/mechanic school had a curriculum that covered basic theory, Morse code, and radio repair. It included an almost frightening amount of material in a very short time, but I was having a ball. The films, lectures, and demonstrations expanded and solidified my knowledge of the theories I had struggled with as a ham. The code classes were pretty much of a bore and I did not advance my speed very rapidly, but I did manage to pass 35 wpm. We were not allowed to use typewriters, however, so I felt that printing at 35 wpm wasn't too bad.

The practical part of the course was a snap, and I became reasonably proficient at the operation and maintenance of such items as the BC-221 frequency meter, BC-375 transmitter, BC-342 and BC-348 receivers, ARC-5-series HF transmitters and receivers, BC-610 transmitter, SCR-522 VHF transceiver, and miscellaneous aircraft electronic gear such as beacon receivers, the radio compass, interphone systems, etc. I was happy to be expanding my knowledge of electronics and was actually a bit sorry when I completed the course.

I declined an invitation to stay at Sioux Falls as an instructor and requested an assignment as a flight radio operator. Within a couple of days I was on another train, now enroute to Kingman, Arizona, this time to qualify as an aerial gunner. I spent some time on the train sewing on my new corporal stripes.

Gunnery school did not have the same fascination for me that I had felt at radio school. While all of the radio operators at gunnery school had to participate in weekly code practice sessions in order to maintain proficiency, I learned a lot more than I thought possible (or necessary) about the 50- and 30-caliber air-cooled machine guns, the 20 mm cannon, hydraulically- and electrically-operated gun turrets, and how to lead or lag moving targets in flight. We spent a few hours in the air shooting at airborne targets, but I enjoyed the skeet shooting part of the course most of all. We learned the basics of leading or lagging moving targets by shooting at clay pigeons from the back of a moving truck! On days off, we were encouraged to shoot regular skeet—the guns and ammo courtesy of Uncle Sam. After the moving truck training, the normal skeet seemed easy and I was soon 25 for 25 most of the time.

I was not sorry to finish the gunnery course although it had qualified me for the first "flight pay" of my life. I left Kingman as a brand new "Buck" Sergeant, and headed for a combat crew assignment at Tucson, Arizona.

It would take a whole

Photo B. Back in Italy just before returning to the USA, W9PJF points to the souvenir Rumanian Air Force pilot wings worn by "Charlie" Kourvelas, the tail gunner.

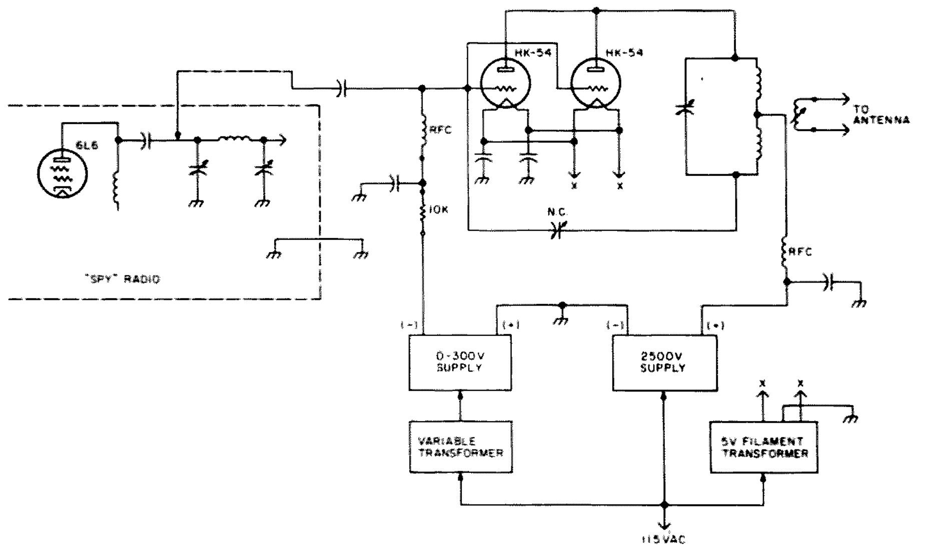

Fig. 1.

book to express my memories and feelings about our ten-man crew formed at Tucson. That crew became my family away from home, and a closeness developed between us that I have not experienced with any other group. Ten semi-trained civilians (four second lieutenants and six buck sergeants) became a reasonably competent crew for a B-24 Liberator, a heavy bomber. We soon were enroute overseas via Natal, Brazil, Dakar, West Africa, Marrakesh, and eventually to an austere base in southern Italy where our 450th Bomb Group joined the newly formed 15th Air Force.

I will always believe that aerial combat was at least as frightening as combat on the ground. Most of the time, our activities were conducted far inside enemy territory with the obvious risk of capture or death a long way from home base. We bombed a number of tough targets. We got shot at and were hit by fire from antiaircraft guns and fighter aircraft. We saw friends disappear in the cloud of an exploding aircraft, and we held back unmanly tears as corpsmen removed bodies from riddled airplanes. Our crew completed 34 missions with many close calls but with no physical wounds. Our flight engineer and I had been promoted to tech sergeant, and the other enlisted men now were staff sergeants. We were flying our third B-24, however: a nearly new one called *Destiny Deb*. Our first two aircraft had been totaled in crashes.

Our 35th mission was to bomb a target that was probably as well guarded as any in Europe. It was the oilfield/refinery complex at Ploesti, Rumania, which was a major source of petroleum products for the Nazi war effort. It was to be our second trip to Ploesti, and memories of the fighters and the intense antiaircraft fire were still fresh in our minds.

That mission turned out to be our last, as *Destiny Deb* was rocked by an enormous explosion just after we dropped our bomb load and while we were making a right descending turn to take up the return compass heading for Italy. An 88 mm shell had exploded between number two engine and the main fuselage, tearing a large hole in the fuselage and rupturing some fuel lines.

Only God knows why we were not immediately surrounded by flames. The number two engine quit immediately, and number three on the other side began to smoke. We fell well behind the squadron and obviously would soon be alone, an easy prey for any Luftwaffe fighters that saw our plight.

The Fates were again kind to us that day, however, and while the number one engine soon failed and power had to be reduced on number three, the old gal flew long enough for us to get well away from the target area. We realized that we would not see Italy very soon as reluctantly we parachuted out over open country near the small town of Bunesti, and soon we were uninvited and unwanted guests of the Rumanian government.

The life and times of a POW in that era cannot be described very well in a few sentences, but a great deal of my time was spent in planning what I might build as my postwar ham station. I was still constrained by my depression views, however, and my most grandiose design turned out to be a T-55 modulated by a pair of TZ-40s. For antennas, I considered the 8JK for 20 and 10 and perhaps a centerfed zepp for 80 and 40. Even the other radio operators in the Bucharest hospital POW camp considered my pages and pages of schematics to be a rather weird pastime.

The Allied invasion in June of 1944 gave quite a boost to our morale, and a spirit of cautious optimism began to spread. All that summer we treasured every scrap of information we could get about the Allied efforts in France. The Rumanians, however, were more concerned about their own future in view of the failures of the Nazi campaign in Russia.

The news of the war on the Eastern front reached us occasionally and, as the Russians advanced, our food improved measurably. The black bread was replaced by brown and the amount of meat in our thin stews seemed to be increased. The lieutenant in charge of our guards sometimes gave us copies of the local newspapers, and the rapid approach of the Russian troops to the Bucharest area was always a headline item. An aura of uncertainty and suspense appeared to envelope our captors and the element of fear could almost be felt. We heard rumors that British paratroopers had been captured, but it seemed hardly likely that any significant British airborne operation could be supported at this great distance from Italy.

One morning, an American major, accompanied by a Rumanian colonel and two men dressed in civilian clothes, entered our enlisted compound and asked if anyone had had any experience in building radio equipment. I explained my background in amateur radio and was told that two British agents had indeed parachuted into the area and that they needed a

power amplifier for use with their small suitcase-sized radio station. Their transmitter provided only about 20 Watts of power, and they had been unable to contact their station in Egypt.

I must admit that I was a little confused by a situation wherein an agent of a nation at war with Rumania was to be assisted by an American prisoner of war in establishing radio contact with an Allied radio station in Egypt. The Rumanian colonel told me that the rapidly approaching Russian forces had created serious political problems and that the British communications arrangements had been approved by "high government officials."

I said that I could build a suitable amplifier if I had the necessary parts, and one of the civilians replied that parts were available. After trading my flying suit for a pair of pants and a shirt, in order to appear less military, I gathered up my small collection of personal belongings and left the prison camp by car in the company of the civilians and two other radio operators, Charlie P. Brewer from Beaumont, Texas, and Ray Jones, RAF, from Sutton, Surrey, England.

We were taken to a large building which must have been part of a university physics department. I was escorted to a room that was full of electronic equipment and told to select whatever I needed. I found many American-made parts and some power supplies that appeared to be operational. I selected some triode transmitting tubes (they were either the HK-54 Gammatrons by Heintz and Kaufman or the 35TGs by Eimac—my memories have been somewhat dimmed by the passage of some 37 years), a 2500-volt power supply, a 300-volt power supply, tube sockets, variable capacitors, wire, solder, a variable transformer (Variac), and an assortment of rf chokes, resistors, insulators, and fixed capacitors.

There was no heavy solid wire available, and I could find no meters or test equipment. I explained my need for wire or tubing to make coils, and one of the civilians said that he would bring some later. The parts that I selected were placed on a bench, and the civilian said they would be delivered to the transmitter location that afternoon.

We left the building and were driven to the Banca Nationale A Romania (The National Bank of Rumania). In one of the basement rooms we were introduced to the two British agents. One was a British captain and the other a Rumanian national who also was a lieutenant in the British army. They showed me their small transmitter/receiver, and I was happy to see that they had several extra coil sets available which I could use in the amplifier circuit.

When the parts from the school were delivered, I assembled a simple power amplifier on a piece of pine board. Electrically, it was a pair of power triodes in parallel (see Fig. 1). The 2500-volt supply provided the plate voltage, and the 300-volt supply, Variac controlled, provided the bias. I used two of the spare coils from the "spy" radio for the amplifier-plate coil and checked for approximate tuning by coupling the output from the small transmitter to the antenna link on the plate coil. Resonance was easily established by tuning for maximum rf voltage in the tank coil.

Next, I capacity-coupled the grids of the power amplifier to the plate of the 6L6 output tube in the small transmitter. I hooked a flashlight bulb to the output link and carefully read-

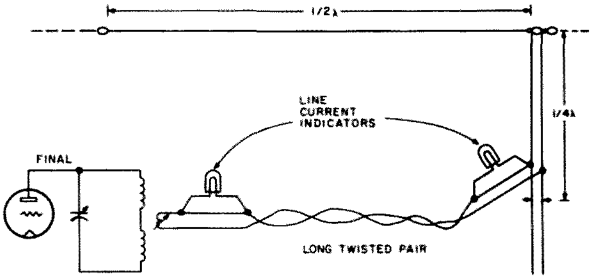

Fig. 2.

justed the amplifier plate, tuning for maximum output. Then the neutralizing capacitor was adjusted for minimum output, and the amplifier was ready for the first trial run. The flashlight bulb was replaced by a 300-Watt bulb, the bias voltage was set for maximum (−300 V) and the 2500-volt supply was turned on.

Surprisingly, nothing blew and no smoke appeared. By decreasing the bias voltage slowly and observing the intensity of the blue glow of the mercury-vapor rectifiers (866s) in the high-voltage supply, I could tell when the amplifier tubes began to draw plate current. I set the bias to a point where a definite plate current was evident and then keyed the small transmitter now being used as a driver for the amplifier. I was rewarded with a brilliantly glowing 300-Watt bulb and a large increase in the mercury-vapor glow.

The amplifier was indeed working and obviously was producing more radio energy than I had ever achieved with any of my ham gear. The only missing element now was an antenna, and the roof of the bank building was an awfully long way from the basement.

It was during this time period that a group of Rumanian leaders formed a provisional government, declared themselves the legal spokesmen, and agreed to cease combat activities against all Allied forces. I was introduced to Dr. Maniu who headed the provisional government and whose temporary abode was also in the basement of the bank. I understood that he had a long history of public service and was well thought of by the Rumanian people.

A man from the telephone company provided us with a large reel of twisted-pair telephone cable, a small reel of bare copper wire, and a great many glass insulators. Charlie, Ray, and I put a half-wave antenna with a quarter-wave matching stub on the roof and used the phone cable as a transmission line to the transmitter (see Fig. 2). The elevator shaft provided the shortest path for routing the cable between the roof and the basement.

During the installation of the antenna, the local German military authorities reacted immediately and harshly to the new government. Several Rumanian civilian facilities were bombed, and, for a few minutes one day while we were on the roof, we watched ME-109s dive-bomb nearby buildings. Luckily, the bank was not selected as a target.

I was concerned about the suitability of the phone cable as a radio-frequency transmission line because of the poor insulation and extreme length of the cable. (No one else there had ever heard about EO-1 cable). As it turned out, the phone cable was very lossy and the

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current flow into the antenna matching stub was much less than the current flow from the amplifier into the cable. In the final version of the antenna, the telephone cable was used as a single conductor connected to a water-pipe ground through the amplifier-output link. The cable length to the antenna was adjusted for best loading. This worked very well, and the British agents were soon in contact with the Allied radio station in Egypt. I have no idea of the purpose or content of their conversations as the messages were all encrypted—by use of the Bucharest telephone book.

The opportunity to improvise electronic equipment had been a splendid diversion, however, and during the two or three day period involved, I was directly concerned in an urgent project that was of value to our allies. During this period, I slept in the basement of the bank and food was sent in from a nearby restaurant. This was overwhelming in it's quantity, and I was never able to eat the entire portion. I took particular delight in the dill pickles since I had not tasted any since being shot down.

Within a few days, Russian troops entered Bucharest and the British and American POWs were flown to Italy in B-17 bombers with the protection of many P-51 fighter aircraft. We spent a few days visiting our respective squadrons and then departed from Naples for a fantastic voyage to the USA. By October of 1944, I was home on leave. I planned to ask for an assignment to a B-29 group so that I could get to the Pacific. That would also give me a chance to tinker with that new Collins rig, the ART-13. ■

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Bored with cranking out the contacts on your expensive transceiver? Been looking for a simple construction project to put some of the thrill back into ham radio? Maybe you'd just like to build something for the fun of seeing what you can make with that collection of old parts wasting away in the basement? If the answer is yes then this is for you.

Believe it or not, here is a surprisingly effective one-tube shortwave receiver you can build in a weekend. The cost is 0 to 15 dollars, depending on your resourcefulness. No slouch on performance, it will pull in just about every signal on the 80-meter ham band that an expensive commercial receiver will hear. As described here, it tunes from 3.5 to 7.5 MHz but the frequency range is determined by plug-in coils and can be extended easily in either direction.

Old-timers have already recognized this project as a regenerative receiver. This type of detector has its roots in the misty past of radio lore and its reputation for high sensitivity is well earned. Early amateurs found that putting an adjustable amount of positive feedback around a detector had several benefits: An astounding amount of gain was available, the selectivity of the associated tuned circuit was vastly increased, and with proper adjustment either AM or CW signals could be copied easily. If a dual triode is chosen for the tube, then one section can be the regenerative detector and the other an audio amplifier. The resulting receiver is easy to construct, sensitive, and inexpensive. It was a very popular design in the 1920s and 30s.

Photos by W1GSL

The one-tube wonder at work.

There are, of course, several drawbacks. To receive code signals the feedback is adjusted so the detector is just barely oscillating, and with that setting a long antenna blowing around in the wind can cause frequency instability on the higher bands. Since the detector is oscillating, a steady carrier can be broadcast via the antenna. A few microwatts isn't going very far but the ham next door might hear it. Furthermore, any receiver with a single tuned circuit will tune rather broadly. While that isn't too much of a problem when all of the signals in the band are of similar strength, a really strong station on a nearby frequency (within 30 kHz or so) can cause problems.

All of these problems were eventually solved with the development of the superheterodyne receiver, but the regenerative detector continued to be used, if to a lesser extent, because of its simplicity and sensitivity. Until the mid 1950s there was always a one-tube regen featured as a good beginner's receiver in the ARRL *Handbook*. Even in the 60s there were designs for simple superhet receivers using regenerative detectors and controlled amounts of i-f regeneration to sharpen selectivity.

So much for history; let's turn to the project at hand. This circuit is a distillation from several described in the literature of the 50s. I tried not to use components that would be difficult to locate today and I'll point out a lot of circuit alternatives to take care of the most likely junk-box shortages.

The receiver uses a plug-in coil—wound on the glass bulb of an extra octal tube—and covers 3.5 to 7.5 MHz. With that coil, the 80-meter band is covered with plenty of bandspread and the 40-meter band tunes pretty rapidly. You can wind other coils easily to cover 40 and 20 meters with plenty of bandspread.

The 80-meter tuning range is a good place to start since that band is not too crowded and the shortcomings of this simple receiver will be more pronounced on the higher frequency bands. The construction is genuine breadboard: very simple and easily adapted

2

to whatever parts you collect. The performance is remarkable. With a 30- to 50-foot endfed wire you will be able to copy just about everything on 80 meters, SSB included, without much problem. In fact, the 80-meter performance compares quite favorably with that of a 5- or 6-tube "all-wave" receiver. The regenerative detector won't tune as conveniently as the superhet, but with a little practice the results are the same.

The Circuit

The circuit diagram for my receiver is shown in Fig. 1. You can copy it exactly or use it as the starting point for your own version. Before getting into possible variations let's take a close look at Fig. 1.

The antenna is link-coupled to the detector coil through three or four turns of wire. This is the swinging coil visible in the photograph. There are two tuning knobs. One 365-pF section of the tuning capacitor from an old tube-type broadcast radio does the main tuning while a smaller, 140-pF variable, tapped down on the coil, is the slower tuning bandspread capacitor. A three- to four-turn feedback winding on the bottom end of the plug-in coil allows the detector to oscillate when the regeneration control is set high enough.

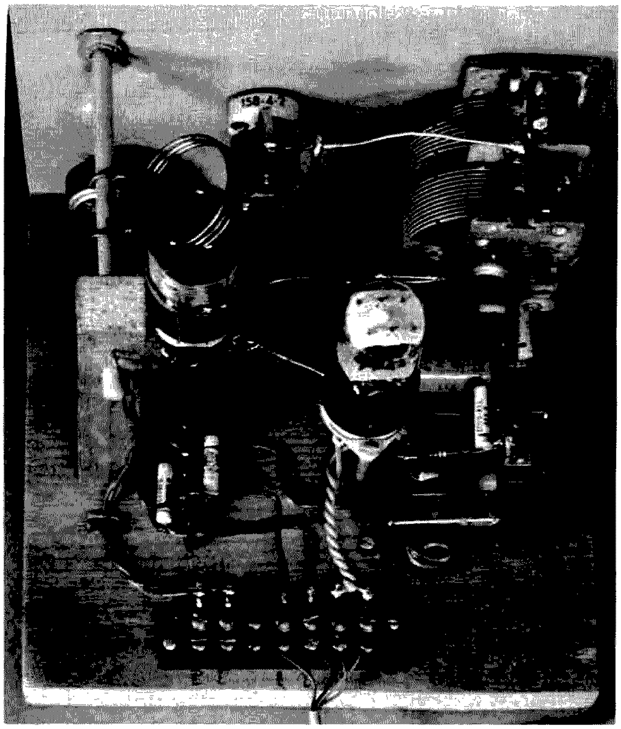
The plate lead from the detector triode is filtered clean of rf after running through that feedback winding and the audio is capacitively coupled into the grid of the audio-amplifier triode. An inductor (the primary of an audio-output transformer) keeps the audio from getting back to the power supply and a 25k pot sets the regeneration level by adjusting the detector's plate voltage.

The audio amplifier is pretty straightforward, except perhaps that the headphones are connected directly into the plate lead. This is simple and works well but please note that the B+ runs through the headphones and you should be mindful of the shock hazard. The headphone jack is wired so that the voltage doesn't appear on the external part of the jack (which is normally grounded) until the 'phones are plugged in and, of course, the jack is insulated completely from the front panel.

The power supply is correspondingly simple. Two small filament transformers feed each other back to back to provide both the 6.3 volts for the filament and a transformer-isolated 115 volts for the B+ supply.

Construction

The physical design is straight out of the 50s. A 7½- by 8-inch board is the base for the receiver, and most of the parts are mounted on terminal strips screwed to this board. The two tube sockets are mounted on 1-inch standoffs. The front panel is a piece of 1/16-inch aluminum to which are mounted the various controls. Most of the rf wiring is hung on the tuning capacitors, so it is important that the front panel be mechanically rigid and electrically shielding. These two conditions ensure a minimum of problems due to microphonics (audio noise in the headphones due to mechanical disturbance of the electrical parts) or hand effect (frequency shifts caused by circuit capacitance variations due to motion of the operator's hands near the receiver).



Behind the dials: A simple circuit and classic breadboard construction.

The antenna is coupled into the tuned circuit by means of a swinging link coil. As can be seen in the photograph, this link is mounted near the middle of a 5-inch length of 1/4-inch-

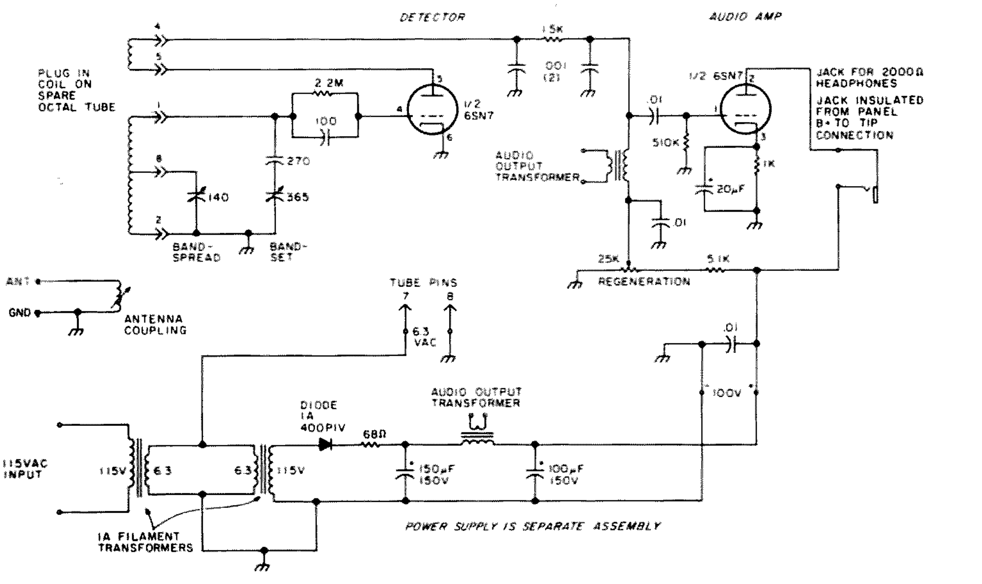


Fig. 1. One-tube receiver schematic.

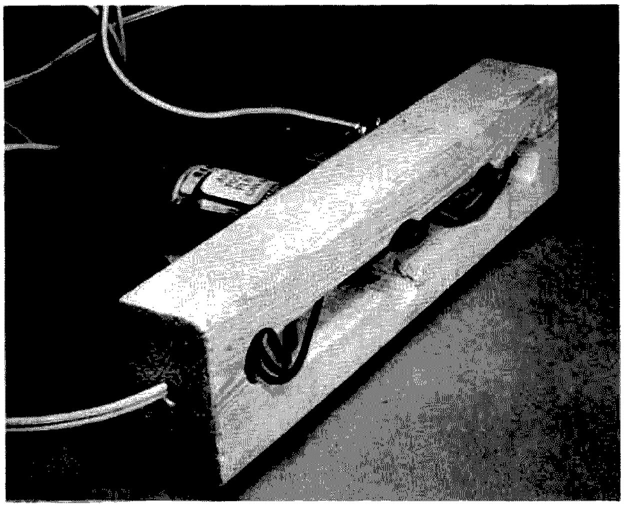
(3)

diameter plastic rod. The rod need not be plastic—any insulating material will do, even wood. The rod is supported at the front panel by a bushing (which was salvaged from an old volume control in keeping with the spirit of the project) and at the other end by a wooden pillar having a 1/4-inch hole through it in the appropriate spot.

The link was formed by winding stiff wire around a wooden dowel slightly larger in diameter than the 6SN7 coil form. The wire is kept under as much tension as possible while winding. The time-honored method is to clamp one end of the length of wire in a vise and, with the wooden form held in both hands, lean back to put tension on the wire as you wind your way toward the vise.

The coil will spring out some when it is taken off the form and probably several turns at the start will be distorted. Save three or four good turns with an inch and a half or so of lead on them. When the rod and 6SN7 coil form are both mounted, you can measure where the antenna link will have to go on the shaft in order to swing over the coil. Drill a pair of wire-diameter-sized holes at the appropriate spots and mount the link through them.

The rest of the receiver layout is pretty well defined in the photographs. I used heavy wire for all of the rf wiring so that vibration-induced microphonic effects would be at a minimum. Your layout doesn't have to match mine exactly as you surely won't have a matching collection of parts.



The power supply: built on a hollowed-out length of 2 × 3.

The construction style of the power supply is also historically motivated. The supply is built as a separate unit to minimize 60-cycle pickup in the receiver. I used a 1-foot-long section of wooden 2 by 3 with a slot jigsawed down the middle to contain the wiring. One concession was made to modern electronic design in the form of a silicon rectifier mounted on a terminal strip hidden under the "chassis." In earlier years, there would have been a 5Y3 or type-80 rectifier tube in the supply.

Alternate Parts and Circuits

Half the fun of building the one-tube receiver is coming up with a suitable collection of parts. The circuits are so noncritical that the builder can substitute with wild abandon and still have excellent results. This is especially true of the power-supply circuit.

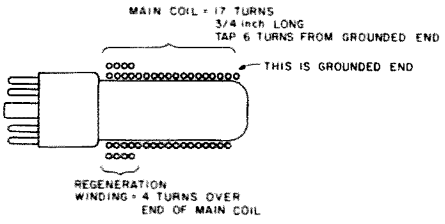


Fig. 2. Coil data for 3.5-7.5-MHz coil.

The receiver needs 6.3 volts ac at .6 Amps and 90 to 200 volts dc at 8 to 20 mA. If you're lucky, you will have a single small transformer providing these voltages and probably 5 volts as well (for a rectifier filament) that you won't need. I didn't have any suitable small power transformers, but I did have a collection of filament transformers. Two were wired back to back as indicated in Fig. 1.

Of course, it is all right to use a single large transformer if that's what's available. If the voltage is too high (250 volts or more), a 10 or 15k, 1-Watt resistor can always be used in place of the filter inductor. A really large transformer, like that from an old TV set, should probably be mounted on a metal chassis for safety's sake—an inverted cake pan will serve if the junk box lacks a chassis.

The rectifier I used is a small silicon unit rated at 1 Amp and 400 peak inverse volts. A full-wave bridge rectifier would be nicer since the 120-cycle ripple is easier to filter than the output of a single diode. The more filter capacitance the better. Don't be afraid to experiment with smaller amounts than I used, but be prepared to add more if hum is a problem. Be sure the capacitors are rated to work at voltages higher than they will see in the circuit. The filter inductor would ideally be a small 5- to 20-Henry unit rated at 20 mA or more. Small chokes, like small power transformers, are not too plentiful these days, so I used the primary of a salvaged TV set audio-output transformer instead.

An entire alternate receiver schematic is shown in Fig. 3. I haven't built a receiver using this schematic, but it is included here to illustrate a number of circuit variations. You can mix and match circuit features from Figs. 1 and 3 to make maximum use of the parts you have on hand. Note first how the antenna is capacitively coupled to the tuned circuit. If you have a small variable capacitor and a big knob, you may find this version easier to build than the swinging link. Both sides of the capacitor must be insulated from the panel and the large knob is desirable since placing your hand near the control shaft may influence the antenna coupling. This circuit arrangement was used in the 1952 ARRL *Handbook* receiver with a homemade capacitor constructed much along the lines of my swinging link—though plates were used instead of coils, of course.

If you have another small capacitor with a suitable shaft, you can use it as a bandspread capacitor. The smallest variable I had was 140 pF, so when I wound my coil I put a tap a few turns up from the ground end and connected that larger capacitor across only part of the coil. A 10- or 15-pF variable can go across the entire coil as shown in Fig. 3, and if you only have several 365-pF units, you can use a tap on the coil even closer to ground than mine. Don't overlook old FM radios as a

source of small-value variable tuning capacitors. UHF TV tuners are another possibility and they often have a built-in vernier dial as well.

The 100-pF coupling capacitor can be any value from 50 to 250 pF and the grid-leak resistor can range from 1 to 10 megohms. Even the tube itself can be changed; a 12AU7 or 6CG7 will work as well as the 6SN7, though the base wiring and filament needs will be different. Naturally a real plug-in coil form will work as well as the spare 6SN7 I used, and any straight-sided glass octal tube will do the job as well as a 6SN7. Be careful not to use both filament pins of a tube for coil connections unless the filament is burnt out. I used #24 solid insulated wire for winding the coils. The coil ends are brought down over the outside of the tube base and soldered to the ends of the pins. A dab of cement holds the wires in place on the glass.

One big change in the circuit of Fig. 2 is that the regeneration control has been replaced by a 365-pF variable capacitor. There is a good reason for this circuit change: lower adjustment noise. The trouble with the 25k pot used in Fig. 1 is that it has dc flowing through it. Carbon pots, unlike wire-wound ones, develop contact noise when used this way and eventually sound scratchy when rotated. I used the carbon pot because wire-wound ones are hard to find, but the variable-capacitor approach is a better solution to the problem and you may want to try it.

A 1- or 2.5-mH rf choke is used in the plate circuit and an audio-interstage transformer provides coupling to the audio amplifier. The audio-output transformer used for this purpose in Fig. 1 could also be replaced with any power-supply-type choke rated at more than 10 mA and 2 H or so inductance. Also shown in Fig. 2 is an audio transformer or supply choke used as a dc feed path for the audio amplifier. This permits ac coupling to the headphones and gets them out of the dc side of the circuit. If your main interest is in CW work, you may want to add some audio selectivity by placing a capacitor across the transformer winding as shown. The resulting tuned circuit can be set to the desired audio frequency by adjusting the capacitor value on a cut-and-try basis. The actual value will depend on the inductance of the transformer you have. Try starting with .01 or .05 uF and listen for an audio peak as you tune across a CW signal. Use a larger- or smaller-value capacitor to lower or raise the peak frequency as necessary.

Operation

Getting the most out of this little receiver is going to require some practice because the controls interact more than they do on a modern superhet. Peaking the preselector control on a transceiver may change the speaker volume a little, but you don't expect it to alter the i-f bandwidth or receiver tuning! Basic operation of the receiver is as follows: The main tuning is set to the approximate frequency of interest and the bandspread control to the middle of its range. The antenna-coupling link is positioned over the top of the coil and the regeneration control advanced. A "plop-hiss" noise in the headphones announces that the detector has started to oscillate. The control is positioned just after the oscillation starts and the receiver is tuned to a signal with the two tuning capacitors.

You will find that the sensitivity and selectivity are greatest with the regeneration set so the detector is close to the oscillation threshold. CW and SSB signals are copied with the detector oscillating, while for AM reception the regeneration is backed down just below the threshold. Often it is easiest to find a signal with the regeneration turned a bit to one side of the critical setting. Increasing the antenna coupling brings up the headphones volume but also reduces the amount of regeneration present and changes the received frequency slightly. The regeneration setting needed to maintain oscillation will vary some with frequency as well. All of this sounds more difficult than it really is. After a little experimentation, you'll find yourself pulling in an amazing number of signals.

Troubleshooting and Calibration

One side benefit of this design is that there is so little to go wrong. If the receiver is built according to the schematic and with good parts, it will most likely work when turned on. If it doesn't, and a series of circuit and voltage checks indicates that everything is OK, then the problem is probably with the regeneration coil. Try reversing the connection of the link winding. If the receiver cannot be made to oscillate on the lower end of the tuning range, then slide the feedback winding closer to the main coil. The coil dimensions recommended in Fig. 2 will surely get you off to a good start but you may wish to experiment with different geometries.

Once the receiver is pulling in signals, you will want to calibrate the dials. This is easy to do with the help of another receiver since the oscillating regenerative detector generates a weak carrier on the frequency to which it is tuned. Set the calibrated receiver to a given frequency, turn up the regeneration control on the little set, then sweep its bandset knob until you hear its carrier in the other receiver. At that setting the two receivers are listening to the same frequency. I glued a paper scale behind my tuning knobs and marked the bandset-dial

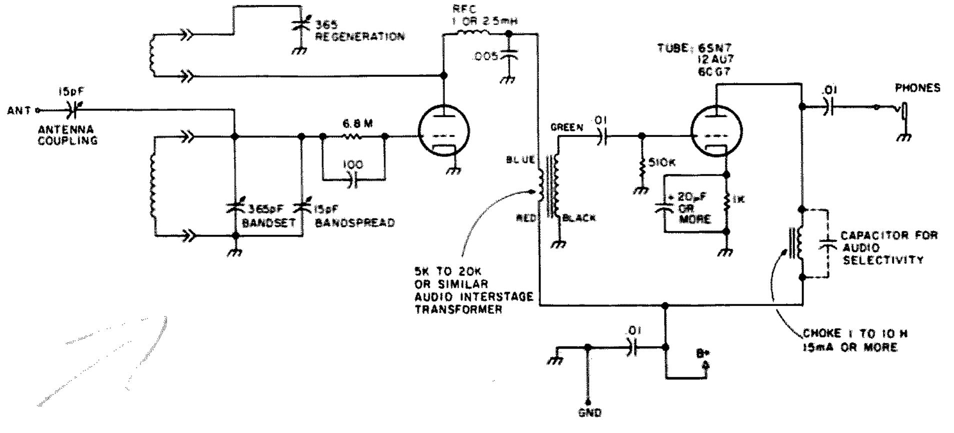


Fig. 3. Alternate schematic showing some possible circuit variations.

position at every half megahertz. The bandspread dial was marked for the 80-meter Novice band and the whole 40-meter band. Of course, the bandspread calibration is only accurate when the bandset knob is set properly.

Other Coils

Changing the tuning range means winding other plug-in coils. Simply use more turns to go down in frequency and fewer to go up. On the higher bands, space out the turns so the whole coil is 1/2 to 3/4 of an inch long. The number of regeneration turns should also increase or decrease one or two, in step with the main coil change. If your main tuning capacitor has two sections, you can place jumpers across otherwise unused coil pins and wire the socket to use both capacitor sections on low bands and only one on the higher frequencies.

A Word of Warning

This little receiver is really a lot of fun to operate. It is cheap to build and can be thrown together in a weekend. If there are a few spare octal tubes on hand, the frequency range can easily be extended in either direction. One word of caution is necessary though. The time will come when you tune across 80 meters with this set and realize that you *can* hear just about every signal on the band. In fact, you could actually use this little gem to make some real contacts (and enjoy shaking up the ham on the other end with a description of your receiver)! After you do that several times you'll naturally start to think about one-tube QRP transmitters. So when nosing around the local flea market for 6SN7s keep an eye out for a slightly larger power transformer, a 6AG7, some 80-meter crystals, and maybe a few old B&W plug-in coils. ■

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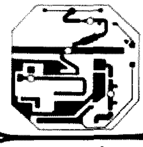

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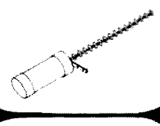

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The Program That Knows It All

Repeater info, third-party agreements, you name it—this TRS-80 BASIC program knows it.

"Hey, OM. Shall I QRQ?"

"Er, uh, yeh. I guess." Boy, I sure wish I knew what he meant! Where did I put that list of Q-signals?

I operate contests quite a bit. I keep a dupe sheet in front of me, but I sure wish I could search through those calls faster!

Has it been ten minutes since I last IDed? Six minutes? Or 12?

Just showed that FCC examiner a few things and upgraded my license. Now let's explore this new territory . . . umm, how far down can I go? Am I in the phone portion of this new band?

Familiar situations? Well, now you can relax. This versatile program will put fun and pleasure back into your hamming. Just by inputting a bit of information about a repeater station (last three letters of its call, its frequency pair, or its location), the program will provide all the information concerning that repeater. If you are a contest operator, this program was made for you. It provides dupe sheet capability with memory and fast recall. No more lost contacts while you check your log to see if you worked that station. Those infrequently used Q-signals are now available when you need them and there is no more wondering whether that country has a third-party agreement before running the phone patch.

MENU OF COMMANDS
1. REPEATER INFO
2. CONTEST OPERATOR
3. Q-SIGNALS
4. THIRD-PARTY AGREEMENTS
5. IDER
6. FREQUENCY CHECK
7. EXIT
COMMAND?

Fig. 1. Sample run of commands available for user.

Fig. 2. Frequency check display showing 3.5-MHz band with operating frequency of 3.7 MHz. A display is provided for each band, 80-2 meters.

I remember when I upgraded and was operating on new and unfamiliar bands, I was constantly referring to a chart to see where the band limits were and if I was still in the phone or CW portion of the band. Before using this program, I still had to resort to that chart when I would occasionally operate on a seldom used band. Now the computer will verify the legality of my operating frequency and visually display where I am operating within that band.

Last but not least, the program provides a visual reminder to satisfy the station identification requirement and will give a flashing reminder when it is time to identify.

Written for the Radio Shack Level II TRS-80 with 16K memory, the program requires about 9K to run. Since there are no unique statements, it should readily adapt to other BASICs. The overall program is actually composed of seven different subprograms. By compartmentalizing it in this manner, the user may choose all or portions of the program to fit his particular needs or memory capability.

Program action is simple to follow. Just respond to the computer's requests and you cannot go astray. The program should be loaded and ready to use when the operator sits down for a hamming session. Then he will have all these capabilities at his fingertips.

Program Introduction: Statement lines 1 through 52 graphically introduce the program and ask the user to input his choice of subprograms. I have made extensive use of the INKEY$ function throughout the program. This allows faster responses and saves wasted effort by not having to use the ENTER key to input data. Safeguards have been incorporated to prevent the program from crashing if a wrong key is inadvertently hit.

Favorite Repeater: Statement lines 100 through 288 comprise the repeater infor-

Program listing.

```
1 REM JACK MARTIN - W8XW
2 REM MAY 1980
9 CLEAR1000
10 DIMF$(10)
11 DIMC$(100)
12 CLS:PRINTCHR$(23)
14 PRINT@448,"*** H A M  H E L P E R ***"
16 FORY=1TO5
18 PRINT@710,"C Q  -  C Q  -  C Q"
20 FORX=1TO200:NEXTX
22 PRINT@710,"
24 FORX=1TO200:NEXTX
26 NEXTY
28 CLS:PRINT"MENU OF COMMANDS"
30 PRINTSTRING$(55,"*");
32 PRINT:PRINT
34 PRINT"1. REPEATER INFO"
36 PRINT"2. CONTEST OPERATOR"
38 PRINT"3. Q - SIGNALS"
40 PRINT"4. THIRD - PARTY AGREEMENTS"
42 PRINT"5. ID 'ER"
44 PRINT"6. FREQUENCY CHECK"
46 PRINT"7. EXIT"
48 PRINT:PRINT"COMMAND?"
50 GOSUB10000:IFVAL(KB$)<1ORVAL(KB$)>8GOTO50
52 ONXGOTO100,300,500,700,900,1100,2100
100 CLS:PRINT"FAVORITE REPEATER INFO"
102 PRINT
104 PRINT"THIS PROGRAM WILL PROVIDE INFORMATION ABOUT"
106 PRINT"YOUR FAVORITE REPEATER(S). ENTER THE LAST"
108 PRINT"THREE LETTERS OF ITS CALL OR THE FREQUENCY"
110 PRINT"PAIR (13/73) OR THE NAME OF THE CITY WHERE"
112 PRINT"REPEATER IS LOCATED."
114 PRINT:PRINT
116 INPUT"STATION";S$
118 X=0:D$="DEG."
120 IFS$="ACO"ORS$="34/94"ORS$="BECKLEY"GOSUB200
121 IFS$="AER"ORS$="22/82"ORS$="CHARLESTON"GOSUB201
122 IFS$="AFE"ORS$="28/88"ORS$="ROANOKE"GOSUB202
198 IFX>0THEN282
199 GOTO280
200 PRINT"WR8ACO,34/94,350 ";D$;" ,BECKLEY,WV":X=1:RETURN
201 PRINT"WR8AER,22/82,345 ";D$;" ,CHARLESTON,WV":X=1:RETURN
202 PRINT"WR4AFE,28/88,76 ";D$;" ,ROANOKE,VA":X=1:RETURN
280 PRINT:PRINT"THAT STATION IS NOT ON FILE"
282 PRINT:PRINT"ANOTHER STATION (Y/N)?"
284 GOSUB10005
286 IFKB=89GOTO114
287 IFKB<>78GOTO284
288 IFKB=78GOTO28
300 CLS
302 PRINT"JUST ENTER CALL SIGN AND COMPUTER WILL LET"
304 PRINT"YOU KNOW IF IT IS A DUPLICATE."
306 PRINT:PRINT
308 INPUT"STATION (INPUT 'S' TO STOP):";A$
310 IFA$="S"GOTO28
312 LETX=0
314 X=X+1
316 IFC$(X)=""THEN322
318 IFC$(X)=A$THEN336
320 GOTO314
322 PRINT:PRINT"THAT IS A NEW ONE -- CALL IT"
324 PRINT:PRINT"WANT IT LOGGED (Y/N)?"
326 GOSUB10005
327 IFKB=89GOTO332
328 IFKB<>78GOTO326
330 IFKB=78GOTO306
332 LETC$(X)=A$
334 GOTO306
336 PRINT"ALREADY WORKED HIM --"
338 GOTO306
470 ,":"
475 ,":"
500 CLS:INPUT"Q - SIGNAL (ENTER 'S' TO STOP):";Q$
502 IFQ$="S"GOTO28
504 X=0
506 RESTORE
508 FORJ=1TO24
510 READA$
512 IFA$="END"GOTO550
514 IFA$=Q$GOTO520
516 NEXTJ
518 IFX>0THEN552
520 ONJGOSUB525,526,527,528,529,530,531,532,533,534,535,536,537,538,539,
    540,541,542,543,544,545,546,547:GOTO518
525 PRINT"QRL: ARE YOU BUSY?":X=1:RETURN
526 PRINT"QRM: AM I BEING INTERFERED WITH?":X=1:RETURN
527 PRINT"QRN: IS THERE STATIC?":X=1:RETURN
528 PRINT"QRO: SHALL I INCREASE POWER?":X=1:RETURN
529 PRINT"QRP: SHALL I DECREASE POWER?":X=1:RETURN
530 PRINT"QRQ: SHALL I SEND FASTER?":X=1:RETURN
531 PRINT"QRS: SHALL I SEND SLOWER?":X=1:RETURN
532 PRINT"QRT: SHALL I STOP SENDING?":X=1:RETURN
533 PRINT"QRU: HAVE YOU ANYTHING FOR ME?":X=1:RETURN
534 PRINT"QRV: ARE YOU READY?":X=1:RETURN
535 PRINT"QRX: WHEN WILL YOU CALL AGAIN?":X=1:RETURN
536 PRINT"QRZ: WHO IS CALLING ME?":X=1:RETURN
537 PRINT"QSB: ARE MY SIGNALS FADING?":X=1:RETURN
538 PRINT"QSK: DO YOU HAVE BREAK-IN?":X=1:RETURN
539 PRINT"QSL: DO YOU ACKNOWLEDGE RECEIPT?":X=1:RETURN
540 PRINT"QSM: SHALL I REPEAT LAST MESSAGE?":X=1:RETURN
541 PRINT"QSP: WILL YOU RELAY?":X=1:RETURN
542 PRINT"QSU: SHALL I SEND A SERIES OF V'S?":X=1:RETURN
543 PRINT"QSY: SHALL I CHANGE FREQUENCY?":X=1:RETURN
544 PRINT"QTB: WORD COUNT AGREE?":X=1:RETURN
545 PRINT"QTC: HOW MANY MESSAGES DO YOU HAVE?":X=1:RETURN
546 PRINT"QTH: WHAT IS YOUR LOCATION?":X=1:RETURN
547 PRINT"QTR: WHAT IS YOUR TIME?":X=1:RETURN
550 PRINT:PRINT"THAT ONE IS NOT ON FILE"
552 PRINT:PRINT"ANOTHER ONE (Y/N)?"
554 GOSUB10005
556 IFKB=89GOTO500
557 IFKB<>78GOTO554
558 IFKB=78GOTO28
600 DATA"QRL","QRM","QRN","QRO","QRP","QRQ","QRS","QRT"
601 DATA"QRU","QRV","QRX","QRZ","QSB","QSK","QSL","QSM"
602 DATA"QSP","QSU","QSY","QTB","QTC","QTH","QTR"
603 DATA"END"
700 CLS:PRINT"THIRD - PARTY AGREEMENTS"
702 PRINTSTRING$(55,"*");
704 PRINT
706 PRINT"(LU) ARGENTINA       (HC) ECUADOR        (EL) LIBERIA"
708 PRINT"(CP) BOLIVIA         (YS) EL SALVADOR    (XE) MEXICO"
710 PRINT"(PY) BRAZIL          (TG) GUATAMALA      (YN) NICARAGUA"
712 PRINT"(VE) CANADA          (8R) GUYANA         (HP) PANAMA"
714 PRINT"(CE) CHILE           (HH) HAITI          (ZP) PARAGUAY"
716 PRINT"(HK) COLUMBIA        (HR) HONDURAS       (OA) PERU"
718 PRINT"(TI) COSTA RICA      (4X4) ISRAEL        (9Y4) TRINIDAD"
720 PRINT"(CM) CUBA            (6Y5) JAMAICA       (CX) URUGUAY"
722 PRINT"(HI) DOMINICAN REP.  (JY) JORDAN         (YV) VENEZUELA"
724 PRINTSTRING$(55,"*");
726 PRINT:PRINT"HIT 'C' TO CONTINUE"
728 GOSUB10005
730 IFKB=67GOTO28
732 IFKB<>67GOTO728
900 CLS:PRINTCHR$(23)
902 PRINT@128,"HIT 'S' TO STOP"
904 PRINT@192,"HIT 'R' TO RESET"
906 A=1:B=0:C=0:D=0
908 PRINT@448,A;"    ";B;"  ";C;"    ";D
910 B=10
911 E=60
913 PRINT@470," ";
914 FORX=1TO320:NEXTX:E=E-1
915 PRINT@470,": ";
918 LETQ$=INKEY$
920 IFQ$="R"GOTO906
922 IFQ$="S"GOTO28
928 IFE=-1GOTO932
930 GOTO913
932 A=0:B=B-1:C=0:D=0
934 PRINT@448,A;"    ";B;"  ";C;"    ";D
936 IFB=0GOTO940
938 GOTO911
940 LETQ$=INKEY$
942 IFQ$="R"GOTO906
944 IFQ$="S"GOTO28
950 PRINT@832,"I D E N T I F Y ! !":FORX=1TO200:NEXTX
952 PRINT@832,"                      ":FORX=1TO200:NEXTX
954 GOTO940
1100 CLS:PRINT"CLASS OF LICENSE"
1102 PRINTSTRING$(55,"*");
1104 PRINT
1106 PRINT"<N>OVICE"
1108 PRINT"<T>ECHNICIAN"
1110 PRINT"<G>ENERAL (OR CONDITIONAL)"
1112 PRINT"<A>DVANCED"
1114 PRINT"<E>XTRA"
1116 PRINT
1118 PRINT"WHICH CLASS ARE YOU?"
1119 GOSUB10005
1120 IFKB=78ORKB=84ORKB=71ORKB=65ORKB=69GOTO1122
1121 IFKB<>78ORKB<>84ORKB<>71ORKB<>65ORKB<>69GOTO1119
1122 LETC=KB
1124 CLS:PRINT"BANDS OF OPERATION"
1126 PRINTSTRING$(55,"*");
```

mation program. When the user responds with the last three letters of the repeater's callsign, its frequency pair (e.g., 13/73), or the city where it is located, the computer will display pertinent information concerning that repeater. One helpful bit of data provided is the proper beam heading for that repeater. Lines 120 through 197 and 200 to 279 are reserved for the user to insert information pertaining to his favorite repeaters. I have put data in these lines just to provide formatting examples.

Contest Logger: This routine is the answer to the contester's prayers. It resides from lines 300 to 338. It will ask for the callsign of the station, check memory, and, if not already logged, will tell the operator that it is a new contact and to call it. If contact is made, the call can be saved in memory for recall later. If the station was previously logged, the user will be informed so that a different station can be checked. Searching action is completed in seconds—a lot easier than trying to find a callsign in a stack of dupe sheets! Statement line 11 is initialized for 100 contacts. This can be adjusted if desired.

Q-Signals: How many times have you heard a Q-signal used and tried to remember its meaning? Statement lines 500 through 603 provide instant recall. The user enters his own catalog of Q-signals into DATA statements beginning on line 600. I have already inserted 23 signals. These can be altered to suit individual needs. The only program modification required is changing the DATA statements and lines 525 through 547 to support the changes made. Be sure the last DATA element is "END".

Third-Party Agreements: This program will display the list of countries with which the United States has third-party agreements. Statement lines 700 to 732 support this function. The list includes call letter prefixes. If the country is not listed, do not make that phone patch!

Station Identification: The operator can initiate this program when the QSO

```
1128 PRINT
1130 PRINT"1. 3.5 (80M)                5. 28.0 (10M)"
1132 PRINT"2. 7.0 (40M)                6. 50.0 (6M)"
1134 PRINT"3. 14.0 (20M)               7. 144.0 (2M)"
1136 PRINT"4. 21.0 (15M)                              "
1138 PRINT
1140 PRINT
1142 PRINT"WHICH BAND ARE YOU OPERATING ON?"
1144 GOSUB10000:IFVAL(KB$)<1ORVAL(KB$)>7GOTO1144
1146 LETB=X
1148 IFC=78GOTO1152
1150 IFC=84GOTO1154
1151 IFC=71ORC=65ORC=69GOTO1156
1152 IFB=3ORB=6ORB=7THENPRINT"NOVICES CANNOT OPERATE THERE":GOTO1182
1153 IFB=1ORB=2ORB=4ORB=5GOTO1156
1154 IFB=1ORB=2ORB=3ORB=4ORB=5THENPRINT"TECHS ARE NOT ALLOWED":GOTO1182
1156 CLS:PRINT"MODE OF OPERATION: (C)W  OR  (P)HONE?"
1157 GOSUB10005
1158 IFKB=67ORKB=80GOTO1160
1159 IFKB<>67ORKB<>80GOTO1157
1160 LETM=KB:IFC=84ANDM=67THENPRINT"TECHNICIANS CANNOT USE CW":GOTO1182
1161 IFC=78ANDM=80THENPRINT"NOVICES DO NOT HAVE PHONE PRIVILEGES":GOTO1182
1162 PRINT:PRINT
1164 PRINT"WHAT IS YOUR PRESENT OPERATING"
1166 INPUT"FREQUENCY (I.E., 14.32)";F
1168 IFC=78GOTO1300
1170 IFC=84GOTO1320
1172 IFC=71GOTO1330
1174 IFC=65GOTO1370
1176 IFC=69GOTO1410
1178 LETX=INT(RND(5))
1180 ONXGOSUB1190,1192,1194,1196,1198
1182 PRINT:PRINT"DO YOU WISH A NEW FREQUENCY CHECK (Y/N)?"
1184 GOSUB10005
1186 IFKB=89GOTO1124
1188 IFKB<>78GOTO1184
1189 IFKB=78GOTO28
1190 PRINT"SORRY - YOU'RE ILLEGAL!!":RETURN
1192 PRINT"BETTER GET BACK IN THE BAND.":RETURN
1194 PRINT"CHECK YOUR VFO. YOU'RE OUT OF THE BAND!":RETURN
1196 PRINT"HERE COMES THE PINK SLIP!":RETURN
1198 PRINT"GOTCHA YOU!!":RETURN
1300 IFF>=3.70ANDF<=3.75GOTO1310
1302 IFF>=7.10ANDF<=7.15GOTO1310
1304 IFF>=21.10ANDF<=21.20GOTO1310
1306 IFF>=28.10ANDF<=28.20GOTO1310
1308 GOTO1178
1310 IFM=80THENPRINT"NOVICES DO NOT HAVE PHONE PRIVILEGES":GOTO1182
1312 GOTO1500
1320 IFF>=50.10ANDF<=54.00GOTO1500
1322 IFF>=145.00ANDF<=148.00GOTO1500
1324 GOTO1178
1330 IFF>=3.525ANDF<=3.775GOTO1358
1332 IFF>=3.89ANDF<=4.00GOTO1500
1334 IFF>=7.025ANDF<=7.15GOTO1358
1336 IFF>=7.225ANDF<=7.30GOTO1500
1338 IFF>=14.025ANDF<=14.20GOTO1358
1340 IFF>=14.275ANDF<=14.35GOTO1500
1342 IFF>=21.025ANDF<=21.25GOTO1358
1344 IFF>=21.35ANDF<=21.45GOTO1500
1346 IFF>=28.00ANDF<=28.50GOTO1358
1348 IFF>=28.51ANDF<=29.70GOTO1500
1350 IFF>=50.10ANDF<=54.00GOTO1500
1352 IFF>=144.0ANDF<=144.10GOTO1358
1354 IFF>=144.11ANDF<=148.00GOTO1500
1356 GOTO1178
1358 IFM=80THENPRINT"YOU ARE NOT IN THE PHONE PORTION":GOTO1182
1360 GOTO1500
1370 IFF>=3.525ANDF<=3.775GOTO1400
1372 IFF>=3.80ANDF<=4.00GOTO1500
1374 IFF>=7.025ANDF<=7.150GOTO1400
1376 IFF>=7.151ANDF<=7.30GOTO1500
1378 IFF>=14.025ANDF<=14.200GOTO1400
1380 IFF>=14.210ANDF<=14.35GOTO1500
1382 IFF>=21.025ANDF<=21.25GOTO1400
1384 IFF>=21.275ANDF<=21.45GOTO1500
1386 IFF>=28.00ANDF<=28.50GOTO1400
1388 IFF>=28.51ANDF<=29.70GOTO1500
1390 IFF>=50.00ANDF<=50.10GOTO1400
1392 IFF>=50.11ANDF<=54.00GOTO1500
1394 IFF>=144.00ANDF<=144.10GOTO1400
1396 IFF>=144.11ANDF<=148.00GOTO1500
1398 GOTO1178
1400 IFM=80THENPRINT"YOU ARE OUT OF THE PHONE BAND":GOTO1182
1402 GOTO1500
1410 IFF>=3.50ANDF<=3.775GOTO1440
1412 IFF>=3.776ANDF<=4.00GOTO1500
1414 IFF>=7.00ANDF<=7.15GOTO1440
1416 IFF>=7.16ANDF<=7.30GOTO1500
1418 IFF>=14.00ANDF<=14.20GOTO1440
1420 IFF>=14.21ANDF<=14.35GOTO1500
1422 IFF>=21.00ANDF<=21.25GOTO1440
1424 IFF>=21.251ANDF<=21.45GOTO1500
1426 IFF>=28.00ANDF<=28.50GOTO1440
1428 IFF>=28.51ANDF<=29.70GOTO1500
1430 IFF>=50.00ANDF<=50.10GOTO1440
1432 IFF>=50.11ANDF<=54.00GOTO1500
1434 IFF>=144.00ANDF<=144.10GOTO1440
1436 IFF>=144.11ANDF<=148.00GOTO1500
1438 GOTO1178
1440 IFM=80THENPRINT"BETTER GET BACK IN THE PHONE BAND":GOTO1182
1442 GOTO1500
1500 ONBGOTO1510,1550,1570,1590,1600,1610,1620
1510 GOSUB1700
1512 X=835:A=3.5:H=3.6:M=3.7:D=3.8:E=3.9:G=4.0:J=127
1514 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E:PRINT@X+50,
     G
1515 X=832
1516 GOTO1900
1550 GOSUB1700
1552 X=835:A=7.0:H=7.1:M=7.2:D=7.3:J=127
1554 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D
1555 X=828
1556 IFF>=AANDF<HTHENZ=(F-A)+A:V=0:GOSUB1800:GOTO1182
1558 IFF>=HANDF<MTHENZ=(F-H)+H:V=10:GOSUB1800:GOTO1182
1560 IFF>=MANDF<DTHENZ=(F-M)+M:V=20:GOSUB1800:GOTO1182
1561 IFF=DTHENZ=(F-M)+M:V=28:GOSUB1800:GOTO1182
1570 GOSUB1700
1572 X=835:A=14.0:H=14.1:M=14.2:D=14.3:E=14.35:J=127
1574 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E
1575 X=821
1576 GOTO2000
1590 GOSUB1700
1592 X=835:A=21.0:H=21.1:M=21.2:D=21.3:E=21.4:G=21.45:J=127
1594 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E:PRINT@X+50,
     G
1595 X=814
1596 GOTO1900
1600 GOSUB1700
1602 X=835:A=28.0:H=28.5:M=29.0:D=29.5:E=29.7:J=127
1604 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E
1605 X=807
1606 GOTO2000
1610 GOSUB1700
1612 X=835:A=50.0:H=51.0:M=52.0:D=53.0:E=54.0:J=127
1614 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E
1615 X=785
1616 GOTO2000
1620 GOSUB1700
1622 X=835:A=144.0:H=145.0:M=146.0:D=147.0:E=148.0:J=127
1624 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E
1625 X=691
1626 GOTO2000
1700 CLS:Y=36
1702 FORX=10TO110
1704 SET(X,Y)
1706 NEXTX
1708 Y=37
1710 SET(10,Y)
1712 SET(30,Y)
1714 SET(50,Y)
1716 SET(70,Y)
1718 SET(90,Y)
1720 SET(110,Y)
1722 RETURN
1800 PRINT@(X+V+Z)-J," U";
1808 PRINT@128,"HIT 'C' TO CONTINUE"
1810 LETO$=INKEY$
1812 IFO$="C"RETURN
1900 IFF>=AANDF<HTHENZ=(F-A)+A:V=0:GOSUB1800:GOTO1182
1902 IFF>=HANDF<MTHENZ=(F-H)+H:V=10:GOSUB1800:GOTO1182
1904 IFF>=MANDF<DTHENZ=(F-M)+M:V=20:GOSUB1800:GOTO1182
1906 IFF>=DANDF<ETHENZ=(F-D)+D:V=30:GOSUB1800:GOTO1182
1908 IFF>=EANDF<GTHENZ=(F-E)+E:V=40:GOSUB1800:GOTO1182
1909 IFF=GTHENZ=(F-E)+E:V=48:GOSUB1800:GOTO1182
2000 IFF>=AANDF<HTHENZ=(F-A)+A:V=0:GOSUB1800:GOTO1182
2002 IFF>=HANDF<MTHENZ=(F-H)+H:V=10:GOSUB1800:GOTO1182
2004 IFF>=MANDF<DTHENZ=(F-M)+M:V=20:GOSUB1800:GOTO1182
2006 IFF>=DANDF<ETHENZ=(F-D)+D:V=30:GOSUB1800:GOTO1182
2007 IFF=ETHENZ=(F-D)+D:V=38:GOSUB1800:GOTO1182
2100 CLS:PRINTCHR$(23)
2102 PRINT@448,"7 3   &   G O O D   D X ! !"
2104 FORX=1TO1000:NEXTX
2106 CLS:END
10000 KB$=INKEY$:IFKB$=""GOTO10000
10001 LETX=VAL(KB$):RETURN
10005 KB$=INKEY$:IFKB$=""GOTO10005
10015 KB=ASC(KB$):RETURN
```

(where's that Q-signal program!) begins. A visual timer will be displayed, updated each minute, and provide a flashing reminder when the time limit has expired and station identification must be made. When the ID has been made, the time can be reset and the sequence repeated. Reset can occur any time by hitting the "R" key. Hitting "S" returns the program to the menu of commands. This IDer routine is in statement lines 900 to 954. The timing sequence is software controlled (FOR...NEXT loop) and may have to be adjusted to allow for differences in machines. Line 914 controls this timing.

Frequency Check: The largest and most complex subprogram, it resides from lines 1100 to 2007. Don't let that scare you, though. If you answer all prompts and data requests when required, the computer will provide the proper response. The program is designed to give the operator the security of knowing his operation is within the band limits established for his license. This verification is supported as the program is run and then reinforced by graphically displaying the operating frequency.

The frequency program can be customized for specific requirements. For example, if you always intend to remain a General, eliminate lines 1102 through 1121 and change lines 1100 and 1122 to read:

1100 CLS
1122 LET C=71

This eliminates answering the class of license question each time the program is run. If your operation is confined to one band, make variable B at line 1146 the applicable value. Also, if you never use CW, make M=80 at line 1160 to establish phone-only operation (also delete lines 1156 and 1157).

As previously stated, this is a highly versatile and useful program, either piecemeal or in its entirety. I believe it contains some routines which every ham will find helpful. I hope it will take some of the paperwork out of your operation and give you more time to rag-chew! ■

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Berserk Direction-Finding

Zero in on transmitters in seconds with this TRS-80 program. It will tell you how to get there, too.

In any radio direction finding operation, whether it be tracking a jammer or a distress signal, the time factor is important. The Radio Amateur RDF Assistant minimizes the time involved in tracking a transmitter. The program allows the operator to determine the general location of the transmitter instantly by entering the headings to the transmitter from two stations whose locations are known. The advantages of this method over the standard map, protractor, and straightedge approach are speed and accuracy. The high speed of the operation allows for comparison of headings from different stations and for quick, repeated calculations if the transmitter is moving.

Other features of the program include the giving of directions to the transmitter for field units and providing a listing of the DF committee members and repeater users, with their calls, phone numbers, and distances and directions to the transmitter, allowing the RDF net control to coordinate the efforts of the stations in reaching the transmitter site. The data for this listing is stored on tape, so the user may have different tapes for different repeaters or bands.

Instructions

After you have CLOADed the program and entered RUN, the computer will ask you if you want the data tape loaded before continuing with the program. You would normally do this when stations will not be giving you bearings immediately, such as right after a jammer or ELT has appeared on frequency. If you need to determine the transmitter's location immediately and have the appropriate information, enter N and the program will continue. You may load the tape later if needed by selecting that option from the menu.

Next, the computer will ask you for the coordinates of station A. Type in the horizontal coordinate, a comma, and the vertical coordinate of the first station that you will be taking a bearing from. (This information can be found by preparing an RDF Map and a Station Data Sheet described later.) Press ENTER and the computer will then ask you the bearing that that station has on the transmitter. Type in this and press ENTER. Repeat the procedure for station B, using a second station. It should be noted that you should not enter two stations that have the same bearings or whose bearings have a difference of 180°. This will result in a divide-by-zero error. This situation is rare and even if the computer were not used the results would be meaningless. The user should simply select another station to replace one of these.

Once this has been done, the transmitter's location is printed along with directions and distances from stations A and B to the transmitter. To see the list of options available, press ENTER.

The first option is DF-Fix Calculations, which was just described. You would select this option if you want to enter a new set of headings to the transmitter. This is the only option that affects the transmitter's location. The other options only use this data to provide related information.

The second option provides directions to the transmitter for a field unit. The computer will ask you for the coordinates of the

field unit. Enter these coordinates. The coordinates can be found by finding the field unit on the RDF Map and finding its corresponding coordinates. The computer will then display the transmitter's location and the distance and directions to the transmitter from the field unit. This information is presented in two forms to allow for different types of field units. If the field unit is a car restricted to streets, the north/south and east/west directions are more appropriate. On the other hand, if the field unit is on foot or in open country, distance and bearing information is more relevant.

The third option is the DF-Net Listing. To use this option, you must have loaded the data tape in or inserted new data (option 5.2) during the current run of the program. The computer will first ask you for a maximum report range. The computer will list only those stations which are within the number of miles you entered to the transmitter. The computer will then ask if you want only DF committee members (those with asterisks at the front of their calls) to be listed. Enter either Y or N. The computer will then list the stations on the screen. It will only show eleven stations at one time, so merely press ENTER to see the next set of eleven. After the computer has listed all of the stations that have met the given requirements, it will tell how many stations were within the given range. You must press ENTER to see the list of options.

The fourth option is to load the data tape. The computer will guide you through the process of loading the tape. The menu will be displayed after the tape has been loaded.

The fifth option allows you to modify the data tape of the DF-Net stations (callsign, phone number, and location). How to determine the station's location will be discussed later. This option has five options of its own. The first merely lists the data. This allows you to check the data and see what, if anything, needs to be changed. The number displayed on the extreme left is a record number. This is the record number you will use in options 2 and 3. Before using options 2 and 3, it is a good idea to check the listing to make sure that you select the right number. To insert a new record, first determine after which record you would like the new record inserted. If it is the first record to be inserted, insert it after Ø.

The third option is the delete option. If you have a station which is no longer active or needs to be deleted for some other reason, find it on the listing (option 1) and note its record number. Then select option 3. Enter this number in response to the computer's question about which record number should be deleted. If you choose to de-

```
4 REM RADIO AMATEUR RDF ASSISTANT
5 REM PROGRAM BY EDWARD W. CRANDELL
6 REM             RT 6 BOX 79
7 REM             WARSAW, IN  46580
10 CLEAR5000
11 M=100
12 DIM D$(M),E$(M),X(M),Y(M)
15 CLS:PRINT"RADIO AMATEUR RDF ASSISTANT":PRINT
20 INPUT"DO YOU WANT TO LOAD THE DATA TAPE NOW (Y OR N)";G$:CLS
21 IF G$="Y"THEN GOSUB240
39 REM DF-FIX CALCULATIONS
40 CLS:PRINT"STATION A":INPUT"COORDINATES";A,B
45 INPUT"BEARING";C:PRINT
50 PRINT"STATION B":INPUT"COORDINATES";D,E
60 INPUT"BEARING";F:PRINT
75 C=450-C:F=450-F
90 C=TAN(C*3.14159/180):F=TAN(F*3.14159/180)
100 G=((F*D)+B-E-(C*A))/(F-C):H=C*(G-A)+B
105 G=INT(G*10+.5)/10:H=INT(H*10+.5)/10
110 X=A:Y=B:GOSUB2000:CLS:PRINT"TRANSMITTER'S COORDINATES: ";G","H
111 PRINT:PRINT"DISTANCE FROM STATION A:";U"MILES":GOSUB1900
113 X=D:Y=E:GOSUB2000:PRINT"DISTANCE FROM STATION B:";U"MILES":GOSUB1900:INPUT"PRESS ENTER TO CONTINUE";P:CLS:GOTO300
140 REM FIELD UNIT ROUTINE
145 INPUT"FIELD UNIT'S COORDINATES";X,Y
150 PRINT"TRANSMITTER'S COORDINATES: "G","H:GOSUB2000
160 PRINT:PRINT"BEARING TO TRANSMITTER:"Z
165 PRINT"DISTANCE TO TRANSMITTER:"U:GOSUB1900:GOTO300
180 REM DF-NET LISTING
181 IFDF=0THENPRINT"***DATA TAPE HAS NOT BEEN LOADED***":PRINT"PLEASE LOAD DATA TAPE OR SELECT ANOTHER OPTION"ELSE185
182 GOTO300
185 INPUT"MAXIMUM REPORT RANGE";L
190 INPUT"DF-COMMITTEE MEMBERS ONLY";H$
191 R=0:V=0:RN=1
195 CLS:PRINT" CALL     PHONE #   DISTANCE  BEARING         DIRECTIONS":PRINT
198 IFRN>TRTHEN230
200 D$=D$(RN):E$=E$(RN):X=X(RN):Y=Y(RN)
205 RN=RN+1
210 IFASC(H$)<>89THENGOSUB2000:GOTO220
215 IF ASC(D$)=42THENGOSUB2000ELSE224
220 IFU<=LTHENPRINT;D$;TAB(9);E$;TAB(20);U;TAB(31);Z;TAB(39);S;A$;TAB(52);T;B$ELSE224
221 R=R+1:V=V+1:IFV<11THEN224
222 PRINT:INPUT"PRESS ENTER TO CONTINUE";P:V=0
223 GOTO195
224 GOTO198
230 PRINT:PRINTR;"STATIONS WITHIN"L"MILES OF TRANSMITTER":INPUT"PRESS ENTER TO CONTINUE";P:CLS:GOTO300
239 GOSUB240:GOTO300
240 REM DATA INPUT ROUTINE
241 PRINT"INSERT DATA TAPE":PRINT"PRESS PLAY":PRINT"PRESS ENTER WHEN READY TO LOAD":INPUTP
242 RN=1:DF=1:CLS:PRINT"FILE LOADING"
243 INPUT#-1,D$(RN),E$(RN),X(RN),Y(RN)
246 IF D$(RN)="END"THEN248
247 RN=RN+1:GOTO243
248 TR=RN-1:RETURN
250 REM MODIFY DATA TAPE
252 PRINT"1) LIST RECORDS":PRINT"2) INSERT RECORD":PRINT"3) DELETE RECORD":PRINT"4) WRITE DATA TAPE":PRINT"5) RETURN TO MAIN PROGRAM
":PRINT
253 INPUT"ENTER SELECTION";Q1:CLS
254 ON Q1 GOTO256,263,277,283,300
255 GOTO252
256 V=0
257 FOR RN=1TOTR
258 PRINTRN;" ";D$(RN);" ";E$(RN);" ";X(RN);" ";Y(RN)
259 V=V+1:IFV<16THEN261
260 PRINT:INPUT"PRESS ENTER TO CONTINUE";P:CLS:V=0
261 NEXT RN
262 PRINT:INPUT"PRESS ENTER TO CONTINUE";P:CLS:GOTO252
263 DF=1:INPUT"ENTER CALL LETTERS OF STATION";D$
264 INPUT"ENTER STATION'S TELEPHONE NUMBER";E$
265 INPUT"ENTER STATION'S COORDINATES";X,Y
270 INPUT"AFTER WHAT RECORD NUMBER SHOULD THIS RECORD BE INSERTED (0 IF THIS IS THE FIRST RECORD)";NR:IFNR<>0THEN271:GOTO275
271 NR=NR+1:FOR FR=TR TO NRSTEP-1
273 NN=FR+1:D$(NN)=D$(FR):E$(NN)=E$(FR):X(NN)=X(FR):Y(NN)=Y(FR)
274 NEXTFR
275 D$(NR)=D$:E$(NR)=E$:X(NR)=X:Y(NR)=Y
276 TR=TR+1:CLS:GOTO252
277 INPUT"WHICH RECORD NUMBER SHOULD BE DELETED";DR
278 IF DR<=TR THEN 280
279 PRINT"RECORD NOT FOUND":GOTO277
280 FOR FR=(DR+1)TO TR
281 NN=FR-1:D$(NN)=D$(FR):E$(NN)=E$(FR):X(NN)=X(FR):Y(NN)=Y(FR):NEXTFR
282 TR=TR-1:CLS:GOTO252
283 RN=1:LR=0
284 PRINT"INSERT DATA CASSETTE IN RECORDER AND PRESS PLAY AND RECORD":PRINT"PRESS ENTER"
285 INPUTP
286 FORRN=1TOTR
287 PRINT#-1,D$(RN),E$(RN),X(RN),Y(RN):NEXTRN
288 PRINT#-1,"END","END",0,0
289 PRINT"TAPE WRITTEN"
300 REM MENU
305 PRINT:PRINT"1) DF-FIX CALCULATIONS"
310 PRINT"2) FIELD UNIT CALCULATIONS"
315 PRINT"3) DF-NET LISTING":PRINT"4) LOAD DATA TAPE":PRINT"5) MODIFY DATA TAPE":PRINT"6) END"
320 PRINT:INPUT"ENTER SELECTION";Q:CLS
325 ON Q GOTO39,140,180,239,250,9999
326 GOTO300
1900 PRINT"DIRECTIONS TO TRANSMITTER:"S;"MILES "A$"    "T;"MILES "B$:PRINT:RETURN
2000 REM CALCULATIONS SUBROUTINE
2001 S=G-X:T=H-Y
2005 U=SQR((S*S)+(T*T))
2006 IFS<>0THEN2015
2007 IFT>=0THEN2215ELSE2220
2015 Z=ATN(T/S)
2025 Z=Z*180/3.14159
2030 IF(S>=0)*(T>=0)THEN2195
2035 IF(S<0)*(T>=0)THEN2100
2040 IF(S>=0)*(T<0)THEN2205
2045 IF(S<0)*(T<0)THEN2210
2050 S=ABS(INT((S*10)+.5)/10):T=ABS(INT((T*10)+.5)/10):U=INT(U*10)/10:Z=INT(Z+.5)
2055 RETURN
2100 A$="WEST":B$="NORTH":Z=270-Z:GOTO2050
2195 A$="EAST":B$="NORTH":Z=90-Z:GOTO2050
2200 A$="WEST":B$="NORTH":Z=90-Z:GOTO2050
2205 A$="EAST":B$="SOUTH":Z=90-Z:GOTO2050
2210 A$="WEST":B$="SOUTH":Z=270-Z:GOTO2050
2215 A$="EAST":B$="NORTH":Z=0:GOTO2050
2220 A$="EAST":B$="SOUTH":Z=180:GOTO2050
9999 END
```

Program listing.

lete a record number that does not exist, the computer will print RECORD NOT FOUND and ask you for the record number to be deleted again. If a record has some incorrect information on it, you must insert the complete correct record and then delete the incorrect one.

The fourth option will write a new data tape with all of the new changes or duplicate the old data tape if it has been loaded in and no changes have been made. To use this option, place the tape you want to put the data on in the recorder. Press the Play and Record buttons on the recorder and then press ENTER on the computer. After the data tape has been written, the computer will return to the main program and display the menu.

The fifth option simply returns you to the main program and displays the menu. You would select this in case you did not want to write a new tape or did not want to write immediately after making the changes.

RDF Map

In order to use this program, you must prepare a map with a coordinate system on it. First obtain a map of the coverage area. This map should have an appropriate scale for RDF use, that is, it should not be so small that one inch equals twenty miles. After the map has been obtained, you should determine what length on the map corresponds to a distance of one mile; for example, 0.5 inch=1 mile. Then, starting in the left-hand corner, you should make a mark every mile along the bottom edge of the map (see Fig. 1). Do the same along the top edge, starting in the upper left-hand corner. Repeat this procedure for the sides, starting in the lower left- and right-hand corners. Next, label them, starting with Ø and going from left to right and bottom to top. The markings on the side of your map should be similar to those in Fig. 1 (different scales and more numbers of course).

After you have prepared the map, you are ready to prepare the DF-Net station data sheet (see Fig. 2). Fill in the call and phone number columns with appropriate information. The first coordinate is the number on the top or bottom of the map which corresponds to the horizontal position of the station. The second coordinate is the number on the sides of the map which corresponds to the vertical position of the station. This sheet is sufficient for using options 1 and 2 of the program.

As has been stated before, in order to use the DF-Net Listing option, you must have previously inserted stations onto the data tape using option 5.2. The option will guide you through the procedure, but a few things should be mentioned before you use the option. First, answer all of the questions the computer asks about the station. Do not leave any answer blank. If a radio direction finding station does not have a call, (e.g., a future ham or SWL), type his name (if it is six or less letters) or his initials in response to the question about the station's callsign. If a station does not have a phone or his number is not known, type in NO PHONE or N/A in response to that question. If you would like a station to be included in a selective printout in the DF-Net Listing, put an asterisk in front of the station's callsign. The asterisk can be used to denote a station who is part of the DF committee or to denote those who have special RDF equipment in their cars, etc.

As well as using the program to find stations, it can be used to calibrate the members' antenna-heading indicators. To use the program for this purpose, RUN the program and load the data tape. Next, you need to insert the coordinates of the station that everyone will be aiming at. To do this, enter station A's coordinates as follows: first coordinate of station being aimed at, Ø. For the bearing, enter Ø. Enter B's coordinates as follows: Ø, the second coordinate of the station being aimed at. For the bearing, enter 90. Press ENTER to get to the menu, and select the DF-Net Listing option. Answer the questions as you normally would. The number in the bearing column of the listing is the direction that each station's heading indicator should show. This information should be relayed to each station so that he can either correct his indicator or make a note of the error and correct for it when he is tracking a station. A good station to calibrate on would be the repeater.

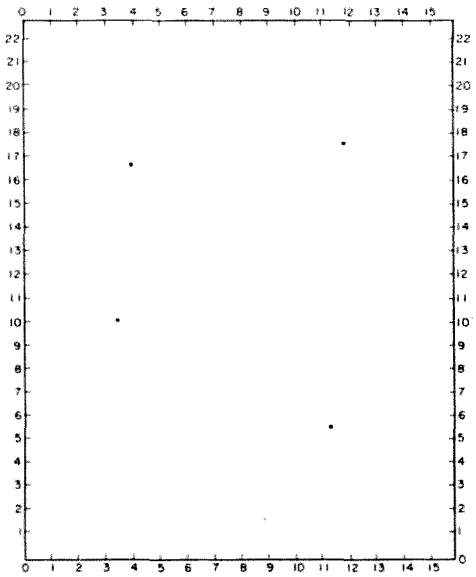

Fig. 1. RDF map.

CALL	PHONE NUMBER	COORDINATES	

Fig. 2. DF-Net station data sheet.

You also may want to include the repeater in your DF-Net Listing so you can estimate the station's transmitter power by comparing the distance to the repeater with the signal strength into the repeater.

Technical Data

The program is divided into six subprograms (DF-fix calculations, field-unit calculations, DF-Net Listing, loading the data tape, modifying the data tape, and the menu) and one major subroutine.

Statements 5 through 12 merely initialize the program. String space (5000 bytes) is set aside and the arrays are DIMensioned to a value of 100. Statements 15 through 21 give the user the option to load the data tape before he actually starts to use the program.

The DF-fix routine (lines 39 through 113) determines the location of the transmitter from the information entered by the user. This location (G,H) is used in all of the other routines for determining the transmitter's relationship to the positions of the other stations.

Statements 40 through 60 prompt the user to input the tracking station locations and beam headings. Statement 75 converts these headings from compass bearings (0° = North, increasing in a clockwise direction) to polar bearings used by the computer. Statement 90 converts these headings from degrees to radians and takes the tangent. Statement 100 solves the simultaneous equations representing the lines from the tracking stations at the given bearings. Statement 105 rounds the results of the calculations (G,H—the transmitter's coordinates) to the nearest tenth. Statement 110 passes station A's coordinates to the variables used in the calculations subroutine. The results are then printed out.

Subroutine 1900 is called to print the directions, since it is used many times. This is again done for station B in line 113. The last half of line 113 is a dummy input used to pause the program and allow the user to continue when he is ready. This is done frequently throughout the program.

The field-unit routine prompts the user to input the field-unit's coordinates, calls the calculations subroutine, and displays the results. It then jumps to the menu. This routine is straightforward in that all it does is format the input and output of the calculations subroutine.

The DF-Net Listing first checks the data flag (DF) to see if data has been loaded in (line 181). The computer then prompts the user to input different parameters for the listing (lines 185 and 190). RN is the record number and specifies which element of the array is to be read. The computer compares the record number with the total number of records (TR). When RN exceeds TR, the listing routine then summarizes the results of the listing. If the user selects the selective printout, the program then checks to see if the first character of the callsign string (D$) is an asterisk (line 215). R is the "stations within range" counter and V is a line counter for limiting the number of stations printed on the screen at one time so that the results do not go flying off the screen before they can be read.

The data tape input routine is also straightforward. DF=1 sets the data flag. One record, D$,E$,X,Y, is input off the tape and stored in an array, with the subscript being incremented after each record. The computer checks D$ for the end of file indicator, END. TR is found by taking the total number of records read (RN) and decreasing it by one to remove the end-of-file indicator from the count.

The modify data tape routine has five options. The first option merely prints out the contents of the arrays. The second option (263 through 276) inserts a new record into the file. First, the user types the information in, then the computer moves all of the records after where the new one is to be inserted up one record number. The new record then is put in the hole left by the records moved.

The delete routine merely moves all of the records above the record to be deleted down one. This destroys that record by writing over it. The program checks to make sure the user does not try to delete records that do not exist.

The fourth option (283 through 289) just outputs the arrays to the tape recorder, using a similar approach to the way they are read in. The fifth option is merely a jump to the menu.

The menu is straightforward, using an ON/GOTO statement to branch. Line 326 takes care of inputs that are not covered in line 325.

The calculations subroutine calculates the distance to the transmitter (lines 2001 and 2005), bearings to the transmitter, and directions to the transmitter (lines 2006-2220). The subroutine is made up of different branches used to correct the ambiguity of the ATN function.

It is hoped that this program and the presence of a good RDF committee will reduce the amount of jamming and be a valuable tool in locating emergency locator transmitters quickly. ■

Variable List

A—First coordinate of station A's location
B—Second coordinate of station A's location
C—Bearing to transmitter from station A
D—First coordinate of station B's location
E—Second coordinate of station B's location
F—Bearing to transmitter from station B
G—First coordinate of transmitter's location
H—Second coordinate of transmitter's location
L—Maximum report range
M—DIMension of arrays
P—Dummy variable for pausing program
Q—Menu selection
R—Number of stations within given radius of transmitter
S—Horizontal distance between a station and transmitter
T—Vertical distance between a station and transmitter
U—Distance from transmitter
V—Line counter in listing
X—First coordinate of station's location when using calculation subroutine
Y—Second coordinate of station's location when using calculation subroutine
Z—Bearing to transmitter
DR—Record number to be deleted
DF—Data flag
FR—Former record number
NN—New number of record after being renumbered
NR—New record number (inserted record number)
Q1—Option selection under option 5
RN—Record number
TR—Total number of station records in arrays
A$—"EAST" or "WEST"
B$—"NORTH" or "SOUTH"
G$—"Y" or "N" to load data tape at beginning of program
H$—"Y" or "N" to "DF-COMMITTEE MEMBERS ONLY?"
D$—Station's call
E$—Station's telephone number

Shack from Scratch

Building a ham shack in a new home can be a breeze. Just plan ahead.

Thomas R. Sundstrom W2XQ
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Vincentown NJ 08088

A man's home may be his castle, but have you tried to install a 6-element, 20-meter beam on a parapet lately? Most homes built or renovated today are not conducive to installing an amateur radio station.

The problem of what to do with the radio equipment confonted me when my wife and I opted to have a new home built in a semi-rural area. In our old home on a suburban lot, it had been make-do in a third bedroom with the attendant problems of running antenna feedlines, supplying adequate electrical power, and establishing decent grounds for the equipment.

My solutions will not necessarily be your solutions, but variations of these ideas may help you in solving your installation problems. Funds were a consideration—the overall objective was, after all, to build the house! But when it was all done, I wound up with a fair amount of operating room, all the electrical power I needed, and a TVI-free environment for less than two percent of the total cost of the house and property.

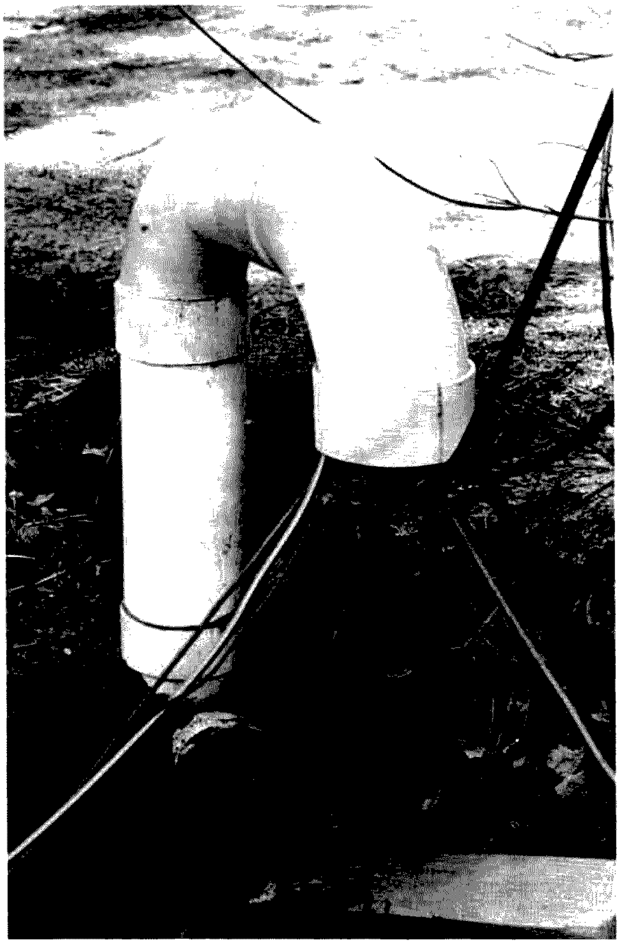


Photo A. The PVC pipe has a couple of elbows on the end of it to keep out rain and snow. A pull rope is left in the pipe to move additional antenna and rotor cables through; otherwise, the open end is capped and covered with dirt.

Review the Plans

Once you have selected the location (no zoning restrictions on towers, right?) and a builder, look over the plans carefully to determine options for the radio room.

In our case, the locale dictated no basement because of the water table. We chose an L-shaped ranch on a slab of concrete. The options were to put the equipment into a bedroom or in the back of the garage. Neither option was desirable.

The solution was relatively simple. The garage was on one end of the house on the long side of the L. We had the builder expand the long side of the L by adding a 6-foot-wide room between the living area and the garage and adding one wall and door. See Fig. 1.

The additional room provided space for the amateur radio equipment, enabled my wife to get the washer-dryer out of an interior closet in the living area, and gave us a mudroom in which to leave boots, raincoats, and other items that should not be trailed across carpeting.

In solving your installation problem, factors to consider would be (1) accessibility to the back yard (or the side yard) for antennas, with a minimum feedline run, (2) keeping the station away from the sleeping areas of the house so that

late night and early morning DXing sessions don't disturb the rest of the family, (3) keeping the family TV antenna, TV, and audio equipment apart from the radio equipment, and (4) the location of overhead power lines coming into the house.

If you opt to expand the house or add an addition to solve the location problem of your equipment, you can hold costs down by doing it in such a way that no new corners are created, needing additional forms for concrete and framing. For example, it would have been more costly for us to tack a room on to the back of the garage, extending that by 10 feet or so. Additional costs would have been incurred for laying forms around two additional corners, a redesign of the roof and supporting rafters in that part of the house, and a reconfiguration of the heating and cooling systems; considerably more concrete, lumber, and siding would have been needed.

Antenna Feedthroughs

Because space for antennas was available in the back yard, I agreed not to punch holes in the sides or roof of the new house and to see that everything was put in the back and out of sight.

Before the slab was poured, I had the builder lay down 4-inch PVC pipe extending from beyond the foundation of the house to the rear of the proposed station operating area. A 90-degree elbow and a short section of pipe at the desk end put that end above the floor level. The poured concrete anchored the 10-foot sections; a board temporarily capped the end outside the house.

Later, I purchased additional sections of PVC pipe and extended the run further into the backyard, bringing it above ground beyond the normal traffic patterns and behind some ground cover. Two 90° elbows are needed so that rain and snow do not enter the pipe. See Fig. 2.

In retrospect, I probably should have put two runs of PVC pipe into the shack area. While one handles a number of RG-8 and RG-8/X and control cables, hardline takes up a lot of room in a hurry.

Factors to consider in planning your own installation include (1) keeping runs of PVC pipe as straight as possible to minimize difficulties in routing cable, (2) leaving a "pull" rope in the pipe so that cable can be fed through from either end at any time (and don't forget to anchor it so that it's not accidentally pulled into the pipe beyond your reach), and (3) consideration of how many antennas and types of feedlines will be installed in the coming years.

Variations on the theme of using PVC pipe to route cable might include using PVC pipe inside the house to route cable to an exterior wall. Place the pipe inside the walls before the sheetrock is hung. Depending upon the design of the house, you may choose to route the pipe and cable to the attic from an interior first- or second-floor room chosen as the "shack," or route it to the basement or the garage before entering the underground run to the antenna tower.

Another variation, for those setting up the operating station in a basement or family room below ground level, would be to bring the PVC through the exterior wall to a point flush with the inside wall. Make up an appropriate bulkhead with connectors and label the lines. In times of electrical storms, shorting plugs can be put on each of the antenna feedthroughs and grounded through the ground attached to the bulkhead plate.

Photo B. The PVC pipe comes up under the operating desk. One of the two ground rods is visible on the right.

Grounds

At the same time that the PVC pipe was laid for the antenna cable runs and before the floor was poured, I installed 10-foot, ¾-inch ground rods at the rear of the area where the operating desk was to be placed. I left them about 8 inches above the finished floor.

That simple move has paid off handsomely in the reduction of in-house TVI and RFI on the operating desk compared with what I had been used to in the previous house. Ground leads are a maximum of 3 feet now.

In your installation, consider the shortest run possible. If you are setting up in an interior room, drop the ground leads through the walls directly to the basement. Use ground rods as long as possible; those 4-foot lengths just won't do the job. Run heavy wire; #4 would be fine. As the heavier wire is a bit difficult to work with, consider tying the heavy ground lead to a heavy-gauge metal plate that has been drilled and tapped with 3/8- or 1/2-inch bolts and place that behind the operating desk. The individual ground leads from the several pieces of equipment can be terminated with spade lugs and bolted to the plate.

Electrical

Before the wall between the added utility room/ham shack and the garage was closed, I had an electrician wire a separate electrical panel for the radio equipment. At the main electrical panel in the garage, a 70-Amp circuit breaker was installed. A three-wire line was run into the shack wall; another panel was installed with a 70-Amp main circuit breaker, and separate circuit breakers were installed to provide 220 and 110 V ac to a number of outlets.

Perhaps this was overkill, but the family members have instructions on how to turn off either main breaker in case of an emergency. Everything goes down when

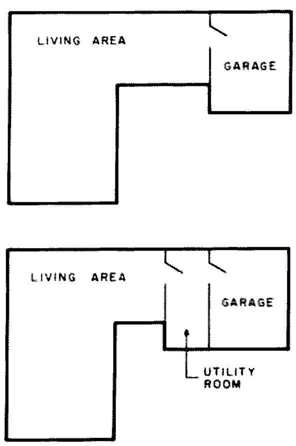
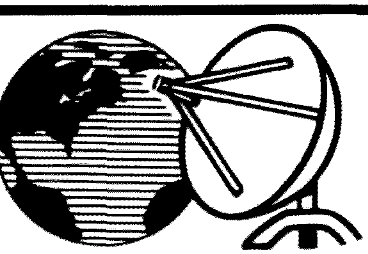


Fig. 1. Before (top) and after (bottom) adjustments to original house plan.



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that switch is thrown. (That panel is low enough for even my youngster to reach.)

Plan your needs carefully. I had eight 110 V ac outlets installed, and still I ran out. Also consider height and placement of the outlets. Don't install outlets at tabletop height if the surface of the operating area runs wall-to-wall; put them above or below the tabletop.

Odds and Ends

Some other planning-ahead activities to consider as the house is framed and before the sheetrock is hung are all based around pre-wiring the house for a variety of items.

Don't forget to get the telephone installer at work before the sheetrock goes on. The job is a lot easier and cleaner. Run a telephone line into the shack, and consider having the house wired for two (or more) telephone lines. If you change your mind at the time the installer returns to fish out the lines to telephone jacks, there is no problem reverting to one line. There is no charge for pre-wiring the framed house.

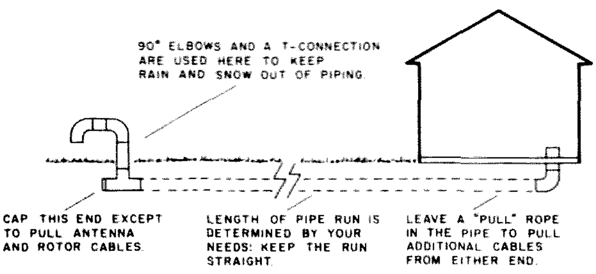

Fig. 2. Details of PVC pipe arrangement which contains coax and control cables.

Want to install a burglar alarm system? A wired perimeter system tends to be the cheapest, and it's easy to do yourself. Supplies can be acquired from a number of wholesale and retail outlets. Pick the system best for you; it may be easiest to install before the walls are closed. Don't forget about electrical power to the system (most systems also have a battery backup).

Also consider pre-wiring for your stereo system. It's a lot easier to run speaker leads in the walls and over ceilings than under rugs or behind wall moldings. Use some larger-size electrical zip cord, such as #12 or #14, rather than the light stuff. Plan ahead for the day when you upgrade to a larger, more powerful amplifier and have speakers in other areas of the house. You can always leave the wires in the walls until you actually have speakers in hand.

An intercom system is also very easy to put in before the walls are closed. Plan ahead. (It's your choice to put one in the shack so that you can be called to do chores in the middle of a contest!)

Be sure to install 75-Ohm coaxial cable for the household TV and FM antenna system before closing the walls. Consider the placement of the antennas with respect to the ham equipment when routing the cable. I opted to install an antenna to take care of both the TV and the FM stereo receiver under the roof of the house, rather than outside, and hung it in the end of the house away from the shack. Plan ahead if you want multiple outlets for multiple TV sets, and don't forget an electrical source for a distribution amplifier if your plans require one. Using shielded cable and picking the right spot for your TV/FM antenna(s) will go a long way to eliminating in-house TVI.

I also took advantage of the open walls to install a coaxial cable which was later hooked up to an attic-mounted scanner antenna and a scanner in the family room; my wife and I eavesdrop on one or two police and fire frequencies, some remote broadcast stuff, and one or two 2-meter frequencies.

In Closing

The building of a new home or of a major addition to an existing home is a massive undertaking. Attention has to be given to everything, and the smallest detail has to be reviewed on a continuing basis. If you tell the builder *before* he begins that you want to install certain wires and pipes for the amateur radio station, there shouldn't be any problems. In my case, the builder gave me a schedule of construction and permission to come in to install the ground rods and the pre-wiring described above; he placed the PVC pipe for me, and the electrician came after I took title to the house.

Keep receipts on everything you purchase and install. That's all part of your tax records for calculating the adjusted cost of the house and the improvements, depending upon the dates involved.

Some of the ideas described above are not necessarily new or original, but they are intended as food for thought. Your needs are different from mine, but if I have reminded you to think about a particular installation problem before you begin a project, then I have been successful. Good luck in your building. ■

Reader Service for facing page ✓5→

Winning the Coax War

The electrical length of feedline depends on its velocity factor. Don't get caught short.

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Benton IL 62812

A review of the basic theory sections of many radio handbooks will reveal references to "dielectric constant" and "velocity factor" as interrelated characteristics that describe real-world influences upon the velocity of an electromagnetic wave and upon the capacitance existing between two conductors.

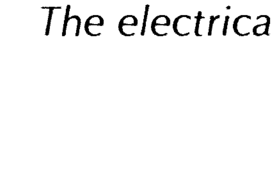

Fig. 1(a).

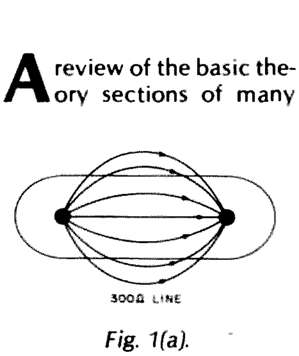

Fig. 1(b).

We don't need to be physicists or to even understand the actions of dielectric molecules to observe that capacitors come in a variety of sizes and shapes. The basic capacitor consists of two conductors separated by an insulator. When the capacitor is charged, the insulator becomes a dielectric because it is then permeated by the electric field between the conductors.

The value of the capacitance depends upon the area of the conductors, the spacing between them, and just what sort of dielectric occupies that space. For example, two sheets of aluminum about 3′ on a side and spaced about 3/16″ apart in a vacuum would form a capacitance on the order of 1500 micromicrofarads, or 1500 picofarads as some may prefer to call it.

If the vacuum between the plates were replaced with glass, the capacitance might increase by a factor of 5 to a new value of 7500 pF. The factor "5" in this case would be the "dielectric constant" of that kind of glass. The thickness of the metallic plates has little effect on the capacitance. For the smaller capacitance values with increased conductor spacings, the "edge effect" requires consideration. This effect is a result of non-linearities in the electric field near the conductor edges. Manufacturers use a variety of dielectric materials to produce the capacitors for today's electronic systems.

Radio signals and other electromagnetic waves travel at a velocity of about 300×10^6 meters per second in a vacuum and just a bit slower in air. This velocity of propagation is equal to about 186,000 miles per second. In liquid or solid materials, the velocity of electromagnetic waves is decreased by an amount depending upon the specific characteristics of the material. A signal travels a distance of one wavelength through space in a period of time depending upon its frequency. Under the (ugh!) metric system, the formula for a wavelength (λ) in space is: λ(meters) = 300/frequency (MHz). In terms more familiar to some of us, a free-space wavelength (λ) in feet is equal to 984/frequency (MHz).

If the same signal had to

travel through glass having a dielectric constant of 5, the distance it would move during the time period of one wavelength would be much shorter. In fact, one wavelength would be only 44.72% of the equivalent length in space. When converted to a decimal figure, .4472, this dielectric correction is the "velocity factor" (VF) of the glass. It is equal to the reciprocal of the square root of the dielectric constant or VF = $1/\sqrt{5}$ = 1/2.236 = .4472. This formula describes the mathematical relationship between "dielectric constant" and "velocity factor."

So, what can we do with dielectric constants or velocity factors? Actually, I can think of very few occasions when changing the dielectric in a capacitor would be necessary, desirable, or feasible. It would be fairly easy, though, to make a low-capacity variable capacitor by using two pieces of aluminum and to insert a variable amount of a plastic dielectric via a shaft and a dial system.

The velocity factor, though, is a much used and occasionally misused factor.

All of the coaxial and parallel-wire feedlines using solid dielectrics are characterized by higher losses than found in equivalent air-insulated lines and by having velocity factors of less than 1. These velocity factors mean that radio waves are propagated along these lines at velocities less than in free space. When the electrical length of the feedline to be used is critical, the velocity factor must be considered in calculating the physical length. If you wanted an electrical length of 1/2λ and the velocity factor was .80, then the desired formula for the physical length in feet would be: 1/2λ = (492 × .80)/frequency (MHz).

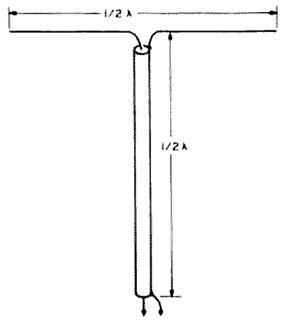

Fig. 2(a).

The velocity factors for some common coaxial feedlines range from .80 for polyethylene foam dielectrics to .66 for solid polyethylene. Some 300-Ohm parallel-conductor feedlines using a solid dielectric of polyethylene have a velocity factor of about .82. Why should that be? Fig. 1(a) shows a cross-sectional view of a piece of 300-Ohm line. The oval represents the solid dielectric and the dots represent the conductors. The arrowed lines represent an instantaneous electric field that might exist at a given moment in time. The fact that a portion of this field exists outside the solid dielectric is the reason that the 300-Ohm line velocity factor of about .82 lies between the .66 factor of solid polyethylene and the value of 1.0 for air. This also explains the sensitivity of oval 300-Ohm line to external influences such as rain, snow, and ice, or to the proximity of metallic objects.

Fig. 1(b) shows the cross section of a 100%-shielded coaxial cable. In this case, the electric field is wholly contained within the shield, and surrounding influences are minimal. That's why coaxial cable can be taped to your tower, run along gutters, or even buried with little observable effect upon its performance.

The velocity factor is used to determine the physical length of the line whenever a particular electrical length of feedline is required, and when in the feedline's use an electric field will exist between the feedline conductors as a result of current flow along the conductors. Fig. 2 shows some of the typical cases wherein the velocity factor would be used in calculating the physical length of the required feedline. In Fig. 2(a), a feedline 1/2λ long is used so that the impedance at the center of the antenna will be repeated at the ground end for easy impedance measurements. The desired physical length of a 1/2λ line would be the free-space length times the velocity factor, or 1/2λ (ft.) = (492 × VF)/frequency (MHz). In this case, the line could be made any whole number multiple of the correct length if a single 1/2λ wasn't long enough.

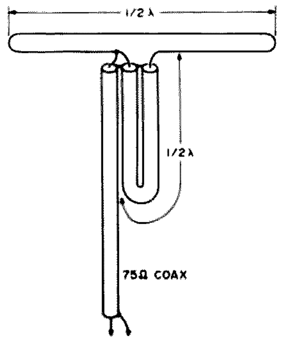

Fig. 2(b).

Fig. 2(b) shows a 4:1 coaxial balun connected to a folded dipole radiator. The length of the 1/2λ U-shaped piece of coax is calculated with VF. Fig. 2(c) shows broadside radiating elements, each fed through a gamma match. Any equal lengths of cable could be used for pieces X and Y to satisfy the phasing requirements of the broadside array. The 3/4λ sections, however, also serve as impedance transformers between the radiators and the feedline junction. The physical length of the 3/4λ lines should be computed with the VF.

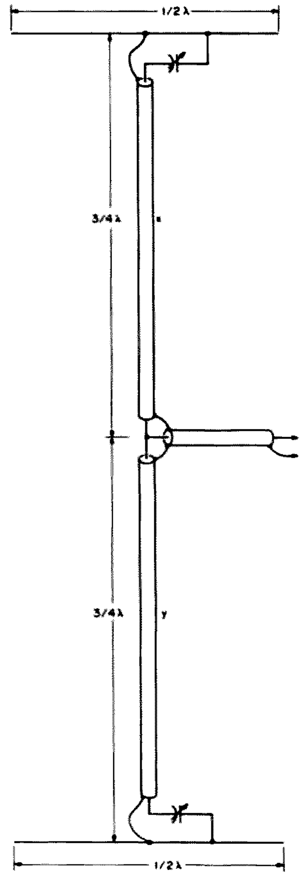

Fig. 2(c).

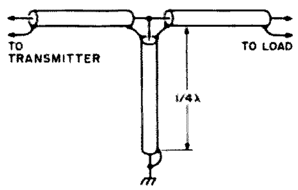

Fig. 2(d).

Fig. 2(d) shows a 1/4λ section of coaxial cable used as an rf choke. The shorted end of the 1/4λ section is transformed into a very high impedance at its connection point to the coaxial feedline. It has no effect upon the feedline as far as the operating frequency is concerned, but it keeps both sides of the coax at ground potential for dc or lightning protection. In addition, the 1/4λ section will act as a dead short across the coaxial cable at the second harmonic!

Fig. 2(e) shows 1/4λ ver-

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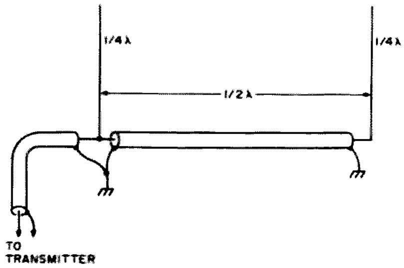

Fig. 2(e).

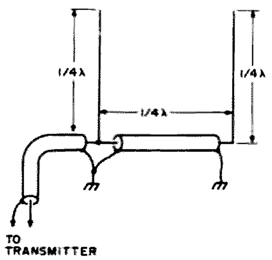

Fig. 2(f).

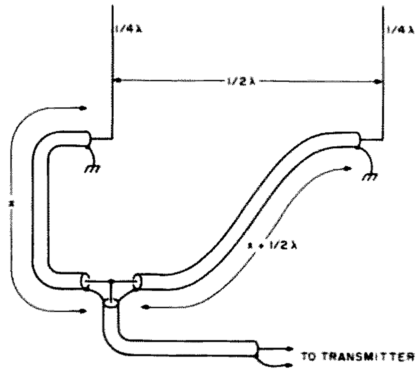

Fig. 2(g).

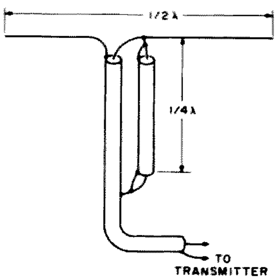

Fig. 3(a).

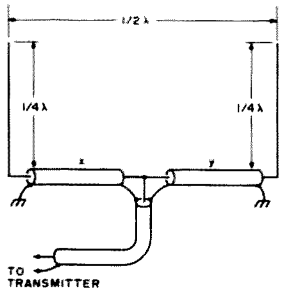

Fig. 3(b).

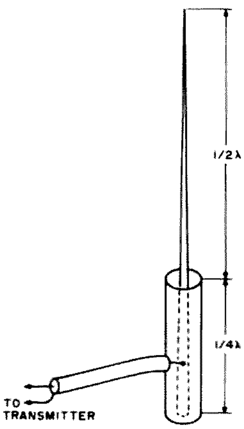

Fig. 4.

tical antennas spaced 1/2λ apart and fed 180° out of phase through a 1/2λ line to achieve a figure-eight radiation pattern. Fig. 2(f) shows similar antennas spaced 1/4λ apart and fed 90° out of phase to produce a unidirectional pattern. The velocity factor would apply to these phasing lines. Please note that Figs. 2(e) and (f) are just basic representations of an antenna system and not a practical arrangement.

How could you make a 1/2λ of coax (free space 1/2λ × VF) stretch between two verticals spaced a 1/2λ (free-space value) apart? It would be impossible unless you used an *air-dielectric* coax and then, of course, its proper length would be equal to the antenna spacing.

The proper phasing with solid-dielectric coax can be achieved as shown in Fig. 2(g). Dimension X is any convenient length of coax. The 1/2λ portion is computed with the VF. While this feedline system provides the proper phasing, it doesn't provide the necessary impedance matching. The same scheme could be used to provide the correct phasing for Fig. 2(f), but then the lines would be X, and X + 1/4λ.

Fig. 3 shows some cases where the velocity factor is *not* used in determining the physical length of solid-dielectric cables. In Fig. 3(a), a 1/4λ of coaxial cable is paired with a portion of the feedline to act as a decoupling stub or balun. Its length is approximately equal to the free-space length of a 1/4λ. The VF of the coax does *not* apply because no electric field exists between the inner conductor and the shield of the 1/4λ of coax. In fact, the inner conductor could be cut off flush with the dielectric, or even removed, as it has no function in this application other than to provide increased physical rigidity. In Fig. 3(b), line segments X and Y could be of any equal lengths and still provide the correct phasing for the broadside array. VF does not apply because a particular electrical length of feedline is not required.

The effects of velocity factor/dielectric constant in places other than feedlines can sometimes be important to the correct functioning of antennas or resonant circuits. For example, a coaxial version of a "J" antenna is shown in Fig. 4. The lower 1/4λ could be an air-insulated high-Q resonant section which matches the high end impedance of the 1/2λ radiator to the coaxial feedline.

This is a good, simple antenna for VHF. If it were to be built, though, you might be tempted to fill the lower 1/4λ section with plastic potting compound for improved physical rigidity or to minimize the effects of weather. Any dielectric added, however, would change the electrical length of the section, thereby detuning the system. A better approach would be to use the velocity factor of the plastic filler beforehand to determine the correct length of a plasticized 1/4λ section.

Why have I persisted in using the free-space formulas times the velocity factor to compute specific physical lengths? What's wrong with the old, tried and true formula, 468/frequency (MHz), to find the length of a 1/2λ? The reason is that antenna design is influenced by something called "end effect." This necessitates just about a 5% reduction of the free-space lengths when calculating the physical length of wire antennas. This phenomenon does not occur in transmission lines, so for these applications we just have to adjust the free-space figures with the velocity factor.

There is no doubt that coaxial cable is the most-used amateur feedline today. Its ease of use more than compensates for its small losses. If you need a critical electrical length, however, don't forget to use the velocity factor established by the cable manufacturer. ■

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Red-Hot and Ready to Go

Anyone who has ever soldered knows that the cord gets in the way. Find freedom with this home-brew cordless iron.

Here's a simple, one-evening project that has proved to be very worthwhile. The end result is an instant portable soldering iron that is heavy enough for most soldering jobs short of antenna and chassis work. Since the tip can be changed from high to low power, the battery life may be extended when only light duty work is involved.

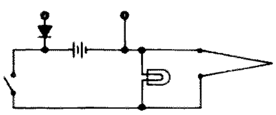
A 6-1/2" × 2" × 1-5/8" box neatly holds the parts, which consist of two size D nicads, two barrier strips, an on/off switch, a pilot lamp, a replacement soldering gun tip, and a diode to facilitate recharging the batteries. The pilot lamp is a #222 (2.25 V, 0.25 A).

Do use the lamp, as it is a very practical visual voltmeter and will give an indication as to when the battery needs a recharge. The tip still will get hot even if one of the cells is run down, and that can lead to deep discharge of the cell. Besides that, the lamp helps you to see where the solder is supposed to go inside of those dark and mysterious projects. (With 3.5-Ah cells and the tip removed, the thing makes an excellent 14-hour emergency flashlight.)

Without a doubt, there are better ways than the one shown to secure the tip, but this method is adequate and allows the business end of the instrument to get into tight places. If you wish to duplicate this mess, use a convenient length of #12 wire. The two-inch length shown has a voltage drop of about 10 millivolts per leg.

The heavy-duty tip, Wahl #7546, draws 8.5 A at 2.5 volts. The regular tip draws 6.5 A. With that kind of current, it is no surprise to find less than 2.5 V at the tip. The measured voltage is close to 2.1. The batteries fell to 2.25 volts.

With that kind of current, the on/off switch must be a heavy-duty type. The least expensive on/off switch that I could get happened to be a push-on/push-off type. Since the iron stands by itself, this allows both hands to be used for bringing the work to the iron—which is often the most convenient way to do it. With the lamp glowing and the point smoking, you are not likely to go off and leave the thing turned on.



REPLACEMENT SOLDERING GUN TIP
#222 PILOT LAMP
SOCKET FOR LAMP
ON/OFF SWITCH
SIZE D CELLS 1AH OR 3.5AH
BARRIER STRIP
BOX
1N4001

Fig. 1.

A quick word concerning the batteries is now in order. With 1.2-Ah size D cells, expect about 8 minutes operating time. Allowing 10 seconds to reach operating temperature and another 10 seconds to make the connection, that would figure out to be about 25 connections (that's the high-power tip). With 3.5-Ah batteries, the arithmetic says to expect about 73 connections. The lighter tip should give about 23% more operating time.

Instant soldering iron.

The batteries may be recharged by means of a suitable current source connected to the second barrier strip. The battery manufacturers normally state on the battery how much current should be used and for how long. The diode is included to ensure that the current is not fed in backwards.

Since this is a cordless iron, there is no cord to use for storing solder. (You do keep a chunk of solder on your regular iron handle or cord, don't you?) The way the solder is stored here ensures an adequate supply and is almost self-feeding.

All of the parts for this project, except the batteries, were purchased new! (Don't faint!) The heavy-duty 3-4 Ah nicads are quite expensive if purchased from the regular wholesale outlets, so try to get them from one of the surplus sources.

The unit has proved itself after many hours of reliable operation. ■

Cutting Current to Size

Measuring large ac currents can be difficult unless you know a trick or two. W7CRY explains how.

Larry T. Wier W7CRY
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Bellevue WA 98007

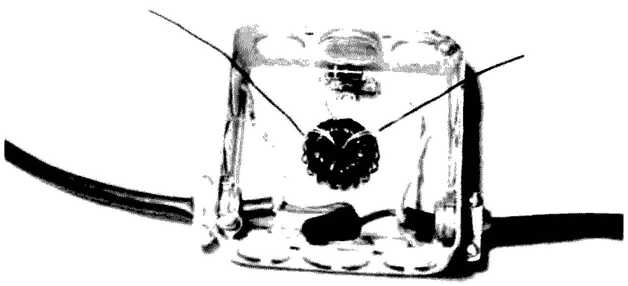
Have you ever tried to measure large ac currents and found your trusty VOM somewhat short? Welcome to the club. I was stuck with the problem of finding the current used by an electric hot water heater but no way of measuring it.

I also found my wallet short after letting my fingers walk through several instrument catalogs. Several hours of thrashing around the workbench yielded a simple and, best of all, inexpensive way of measuring large ac currents using an ordinary 88-mH choke, a trick or two, and Ohm's law.

Theory

Perhaps a little transformer theory should be covered before Ohm's law and the tricks are applied.

By definition, a transformer is exactly what its name implies: It transforms one voltage (or current) to a different level. The major differences between a voltage transformer and current transformer are the turns ratio and power-transfer characteristics. Depending on design, the voltage transformer has a low turns ratio, i.e., approximately 19 to 1 (118/6.3) for a filament transformer. The current transformer, on the other hand, has a turns ratio from around 300 to greater than 10,000 to 1, depending on the burden (load) on the secondary.



The almost-completed ac current transformer. The transformer is mounted on a piece of styrofoam™ which is glued to the box. Contact or rubber cement can be used for both the foam and transformer. The signal wires (not shown) can be routed out through any of the knockouts.

The current transformer always has the burden specified along with the current ratio. For example, a typical 50-Amp to 5-Amp current transformer will require a burden of .25 Ohms. If the secondary burden were to open or be removed, the transformer would be destroyed because the voltage developed across the resulting open circuit would cause arcing within the windings.

An additional consideration is that the current transformer should not introduce significant changes in the circuit being measured.

Hybrid Current Transformer Design

Fig. 1 shows the basic technique in utilizing the 88-mH choke as a current transformer. The term hybrid is used because in using the choke, a "halfway in-between" turns ratio will result. The approximate number of turns is determined by measuring the resistance of the coil, finding

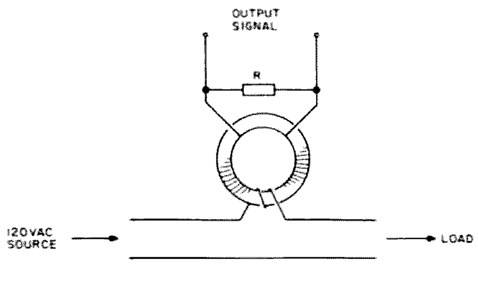


Fig. 1. Basic hybrid current transformer.

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the wire size, and, from a wire table, finding the resistance per foot. By taking the average diameter of the donut and average cross section, a rough turns count can be calculated.

For those not willing to take the time to play with the math, a quick test can be found in the calibration section. If the ratio is found to be in excess of about 300, the choke is a good candidate.

Apparently, there are several so-called surplus 88-mH-type chokes. I found some with and some without center tap. I have also found some with two separate windings. These can be used if the windings are connected in series adding. Even though the choke defined here was intended for the audio frequencies, it works well at 60 Hz if the power levels are kept low.

Construction

The only construction required is covering the existing windings with tape. Once the value of R is determined, it can be soldered to the windings and taped to the body of the coil or mounted as shown in Fig. 3. The signal wires are attached across the resistor and routed where necessary. Wire length is not critical, but wires should be routed away from high-noise areas.

Calibration

Fig. 2 shows the test setup used to calibrate the current transformer. It is not necessary to use the 120-volt, 60-Hz line to do the calibration. As shown, a low-voltage, high-current voltage transformer with an adjustable input is the quickest and safest.

For calibration purposes, R can be a quality pot. The 100-Ohm resistor is used to prevent shorting the transformer, but is part of the burden. The source and load will depend on what is available. Use the following steps to calibrate the transformer:

1) Make sure that there are ten complete turns of #18 insulated wire wound as shown in Fig. 2.

2) Adjust the load for 10.0 Ohms.

3) Adjust the voltage to the load for 10.0 V ac.

4) Adjust R (1k pot) for an even value of voltage—preferably 0.1 V ac. Remove power.

(If 0.1 volt was not obtainable, replace R with a 2k pot. If the measured voltage was higher than 0.1 V ac, set the value to any even value above 0.1 V, e.g., 0.3 V ac.

(The current ratio is calculated as follows: $I=E/R$, where E was set to 10.0 V ac and R was set to 10.0 Ohms. Therefore, $I=10\ V/10\Omega=1$ Amp.

(Then 1 Amp through 10 turns equals 10 Amp/turns which is also equal to 10 Amps with 1 turn through the transformer. With one turn in the primary and the measured value across R of 0.1 V ac, the ratio becomes 10 to 0.1. By Ohm's law, E is equal to I times R, and if R is held constant, then E must be proportional to I.

(What this boils down to is that the current through the transformer will generate a proportional voltage across R as long as R stays constant. If the ratio has been set correctly, adjusting the load to 1.0 Ohms and again adjusting the voltage across the load to 10.0 V ac, a value of 1 V ac should be measured across R.)

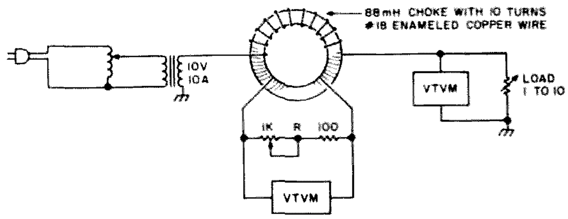

Fig. 2. Calibration test setup.

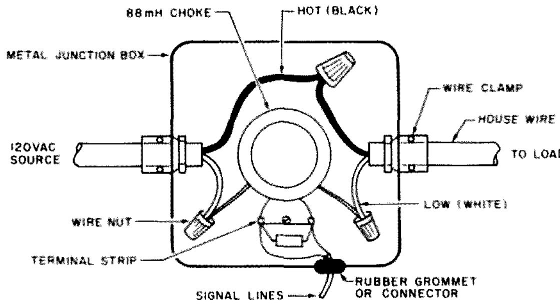

Fig. 3. Mounting fixture.

5) Determine the wattage for R by measuring the value of R and calculating as follows: $P_{Watts}=E^2/R$. Generally, a ½-Watt resistor will be more than sufficient. Replace the pot and 100-Ohm resistor with a fixed value equal to the combination of the two in series.

Application

Obviously, this combination can be used with any current range. It is limited only by the size of wire capable of being wound (1 turn) through the donut. Note that at least one turn is necessary to excite the transformer core. Passing the wire through the hole is not sufficient. Practically speaking, a #5 (solid enameled) wire is about the maximum-size wire which can be formed into one turn around the donut. This limits the upper current range to around 50 Amps.

The number of turns wound on the current transformer will depend on the current range to be measured and wire size. As an example, suppose a motor rated at 15 Amps (running) is to be monitored. We know from our calibration that 10 Amps gave us 0.1 V ac across R. Therefore, one turn of #12 wire through the donut should give us 0.15 V ac across R. The #12 was chosen because it is the smallest size generally used for motors in this range.

Another example is the case where only 1 Amp is to be measured. In this case, the wire size (assumed to be #14) is too large to pass a large number of turns through the donut. If you can assume also that nothing larger than approximately 5 Amps will be

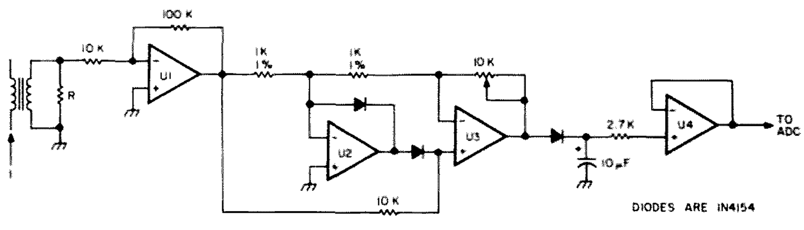

Fig. 4. Precision rectifier/buffer.

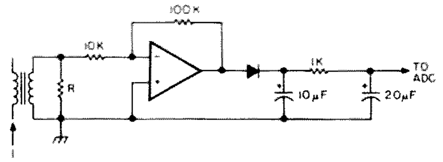

Fig. 5. Half-wave rectifier.

passed through the donut, then ten turns of #18 (solid enameled) will generate 0.1 V ac across R. In most cases, the number of turns will be determined by the measurement requirements.

Installation

According to most electrical codes, any splices of power lines must be located in a box. An outlet or junction box will work equally well. The transformer should not touch the metal box, and make sure that only the circuit being measured is in the box. It is best to use the low side (white wire) because the voltage between the low side and ground will not exceed the voltage rating of the enameled wire.

When measuring a 220-V ac line it will be necessary to use either of the two hot (red or blue) lines. In this case, the donut should have at least one layer of electrical (plastic) tape between the two sets of windings. Fig. 3 shows one method of mounting the donut and resistor R. Any method which meets your local code requirements will work.

Use

Now that you have a current transformer, how can it be used? The answer to that depends on why it was built. The easiest use of the current transformer is with an ac voltmeter. In my case, it is being used in a computer-controlled power system. Since a computer does not know ac from dc (or much else), the ac signal across R must be signal conditioned. There are many ways to signal-condition, but the method I chose was determined by the analog-to-digital converter (ADC) used with my computer. It has ±15 V dc available, so that the use of operational amplifiers seemed to be the best solution.

Fig. 4 is an example of how the ac signal is conditioned from ac to dc for the ADC. It is beyond the scope of this article to dissect the operation of Fig. 4 except to note that U2 and U3 form an absolute value (precision-rectifier) circuit. U1 is an inverting amplifier and U4 is used as a unity-gain buffer. U1 and U4 are in one LM747 and U2 and U3 are in another. Any general-purpose operational amplifier will work. (More information on this particular absolute-value circuit may be found in the November 8, 1979, issue of *Electronic Design*, page 94.)

A simple amplifier and diode arrangement also will work if accuracy and response time are unimportant. Fig. 5 is the method used in this case.

Summary

No matter what the requirement, a simple arrangement such as described here will provide a reasonably accurate measurement of ac line current. Sources of 88-mH chokes are found in the back of most electronic magazines and cost around $3.00.

Now I need to look into a method of measuring the gas pressures in my heat pump! ■

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Alexander MacLean
WA2SUT/NNN0ZVB
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Denville NJ 07834

Construct This All-American Audio Signal Generator

The perfect project for starting a test bench or rounding one out.

It is still possible for the average builder to design and make equipment that is competitive in cost and effectiveness with that which is store-bought. Many simple, standard design concepts can be applied to modern technology.

The Circuit

This FET audio signal generator is an easy project derived from the audio oscillator circuit presented in "Working with FETs—part 1," in *73* in November, 1979. There are some simple additions in the finished circuit which make it far more useful than just the basic circuit (see Fig. 1).

I could have used a switch and a selection of fixed values, but it would have cost more and built in a fixed limit. The easy way out was to put the frequency-determining capacitor outboard so that it can be changed quickly. You can use a substitution box or your junk-box selection with ease, but most of the time you can just leave the fixed value in place. I have rarely needed more than the one tone for testing.

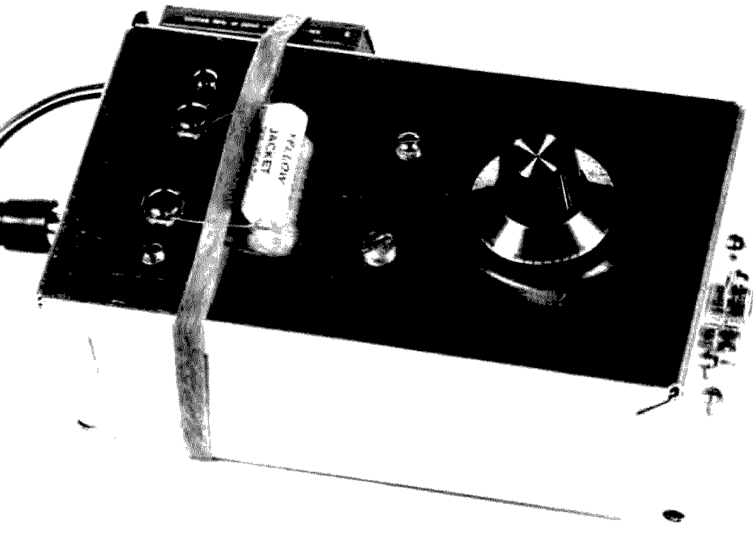
Potentiometer R2 gives you an adjustable output level. This is very handy for testing or troubleshooting. Resistors R3 and R4 form an output attenuator network that gives you a low-level adjustable output. This is useful when working with high-gain circuits. Using an attenuator network gives you a cleaner low-level signal than trying to use a high-level signal at the lowest setting.

A 9-volt transistor radio battery or a power supply can be plugged in at J3. This way you can change quickly between battery and fixed supply, or use your battery or supply with other equipment. It's handy. The low power drain, about 2.2 mA, makes this a really practical project for battery and portable operation.

There are only a few parts values that are at all critical. The design center was for 10% tolerance and in most cases it is much wider. Except in one important case, the voltage rating is anything reasonable over 20 WV dc.

L1 is an 88-mH unpotted toroid. It is a common surplus item, but you may have to look around. They are often used for filters in RTTY equipment.

C1 in combination with L1



Top view of FET audio signal generator.

is what actually sets the audio tone. My substitution box gave usable tones from 0.22 uF up, but the highest tones were out of the comfortable audio range. I think that 0.1 uF to 0.22 uF would be a good starting point. Get out the junk box and play around.

R1 limits the voltage swing of the output waveform at the gate of Q1. If it were not there, under some conditions the signal might be large enough to damage the transistor. The value is not critical; 3.3k or more will do, but have something there for protection.

Q1 is a Motorola HEP-801, a commonly available audio FET. It has four pins, the fourth being a connection to the outer case. When I made the prototype circuit, the matrix board automatically connected the case to the source pin. It worked well that way so I left it in the finished circuit.

Drain bypass capacitor C5 is not critical. Anything from 20 to 100 uF at 20 volts or more should do. The circuit worked well without it, but it might be needed to keep any noise from getting in from your supply. Keep in mind that to further decouple the circuit you can also add a 2.2k or so resistor in series with the drain line if you have a stubborn noise problem. The greater the capacitance of output coupling capacitor C2, the better the low frequency response. I used a 0.1-uF 50-V-dc disc ceramic that was on hand.

Output level control R2 is a 50k linear-taper potentiometer. A linear taper is used because it is a voltage divider application, not a true volume control. Mine has an ac switch (SW1) right on the back, but you can use a separate switch.

R3 (470k) and R4 (47k) form the attenuator network. The textbook values would be different, but since I aimed for a wide 10% tolerance, it worked out well. The measured output is very close to a 10:1 ratio. My resistors happen to be 5% values as they were available in the store. Output coupling capacitors C3 and C4 have the only critical ratings: Both are 0.01 uF at 1000 volts disc ceramics.

The voltage rating is critical. They block any dc voltage in the test circuit (such as a tube-type amplifier) from getting back into the generator and frying all the little parts. Use at least 500-volt capacitors, preferably higher. You should not be using equipment like this in really high-voltage circuits. It's unhealthy. But a good safety margin will keep you going when you work with most tube-type equipment.

These two capacitors also will determine the frequency response of your generator and it's hard to find high capacitance at high working voltage. This means that your lowest audio tones will have less output voltage than mid or high tones.

I should stress that the low-frequency loss comes from the coupling capacitors in the circuit, not the oscillator, which will provide far flatter output across the audio spectrum.

Construction

Construction is easy. There are only a few mechanical problems to watch for. The photos show the parts layout and there are a few tricks to make it easier.

I used cardboard at the top and bottom of toroid L1 and a short length of insulation over the screw where it went through the toroid to prevent any shorting.

There is one potential trouble area. Clean the enamel off the magnet wire ends of the toroid very carefully. I mean really get in there with a sharp penknife and *scrape it off*. I was sloppy the first time. It looked good but it didn't work. It took me a while to find the problem. Check for a good clean contact with your ohmmeter. It doesn't matter which end is grounded when you install it, but when you make the center-tap, look for the two ends that are closest together.

Use a good quality transistor socket. The cheap one I tried at first fell apart. I soldered the leads to the socket first and then wired it to the terminal strip. I was going to tack it down with silicone sealer, but the wire was stiff enough that it didn't wander.

RCA jacks were used throughout. They are not the last word in connectors, but they are cheap and easy to get.

There are many styles of enclosure available; it just has to all fit. I did not try

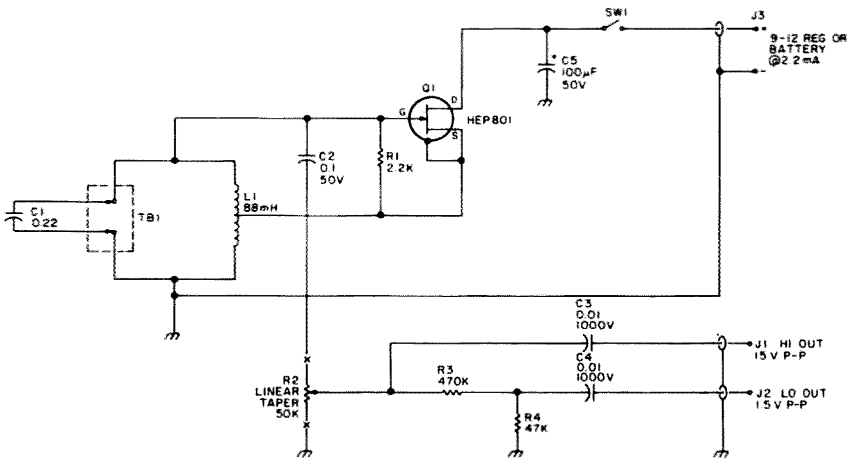


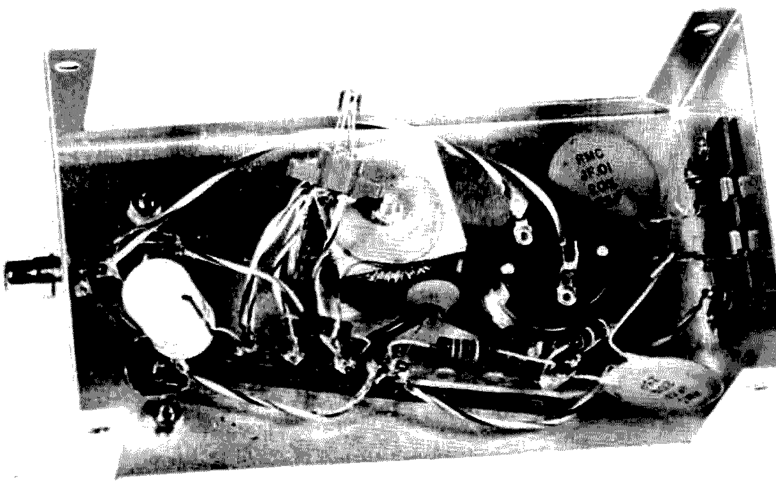
Fig. 1.

Parts List

C1—0.22-uF, 20-volt or greater
C2—0.1-uF, 50-volt disc ceramic
C3,C4—0.01-uF, 1000-volt disc ceramic (voltage rating critical)
C5—100-uF, 50-volt electrolytic
J1, J2, J3—RCA jacks
L1—88-mH toroid
R1—2.2k, ½-Watt 5 or 10%
R2—50k, linear-taper pot. (Radio Shack 271-1716)
R3—470k, ½-Watt 5 or 10%
R4—47k, ½-Watt 5 or 10%
SW1—ac switch, part of R2 (Radio Shack 271-1740)
Q1—Motorola HEP-801 n-channel FET

Miscellaneous

Minibox—5-1/4" × 3" × 2-1/8" (Radio Shack 270-238)
Knob—Radio Shack 274-413
TB1—2-screw terminal strip
Solder terminal strip (see photo)
Transistor socket
Mounting hardware



Bottom view.

to miniaturize. It's small enough now to be handy but large enough to service easily. Notice that the leads are not as short as they could possibly be. It's neat, but there is room and length to work with.

The only part that might be a problem to buy is the toroid. They are still common mail-order items if you check the RTTY supply houses. Get a few; they're useful. Almost any of the other parts are common enough that you may be able to use some of them to make up a minimum order requirement.

I spent a little under $9 to build the signal generator. I had the toroid, transistor, and some of the small parts, but I bought the rest new to get the prices. I would estimate that it can be built for about $12 if you are careful, and within $15 without too much trouble.

Testing

When you have it put together, check for wiring errors and shorts. Put your milliammeter in the power lead and check the current as you turn it on. Don't forget to put some capacitance value at TB1 (C1) so there will be a complete LC circuit.

Use your scope or high-impedance headphones to check for a tone. If it works, use your scope or VTVM to measure the output voltage at both output jacks as it may vary between units. Don't try to use a VOM on the low-level output. It will load it down to almost nothing. Check for proper operation of the level control and the on-off switch. If you get past all that, you are in business.

The first time I tried mine it didn't work and I designed it! Here are the most likely troubles to look for:

1) Transistor inserted incorrectly in the socket, or you have the wrong pin configuration to the circuit.

2) Weak or dead battery. Check yours under load with meter.

3) Wiring error. Recheck schematic.

4) Coil doesn't make connection with rest of circuit. Unsolder and clean again. Ohmmeter might help here.

The signal should be at the gate of the FET. Lifting one lead of C2 will isolate the output circuit. If there is still no signal at the gate, then the trouble is in the oscillator circuit itself.

Performance

I checked the performance of mine with my usual assortment of ancient and out-of-tolerance test gear and got the following.

The output voltage varies only slightly over the supply-voltage range of 9 to 20 volts. This is a fringe benefit of R1. It holds the output voltage constant over a wide range of supply voltages.

The output drops off slightly with a supply voltage between 9 and 5 volts. At the design center of 9 to 12 volts, the drain current is about 2.2 mA.

The output voltage at the HI output jack (J1) is 15 volts peak-to-peak on the scope. At the LO jack (J2), it is 1.5 volts p-p. Pretty good for a rough and ready attenuator network.

The calculated rms voltage by formula was not what one meter showed. The VOM indicated 4.2 volts rms. The LO range was loaded down too much by the meter. The output across the "output" jack was about +15 dBm—enough for many purposes.

The minimum signal voltage available is about 0.01 volt p-p on the scope. The voltage is still controllable below this level, but you are at the extreme end of the range and there is a higher level of hum vs. signal. Some noise will get in from any test setup, but at very low levels, noise and crud are a higher percentage of your actual test signal.

Your performance measurements will probably vary from mine because of differences in the unit and test equipment used. The absolute values are not as significant as knowing the relative values as measured by your own equipment. This gives you a way to check the performance against a recorded value.

Always keep records on the operating characteristics of equipment you make when you complete it. Then you will have figures to use for comparison when you need them. It won't be guesswork or vague memory.

Odds and Ends

There are a few little odds and ends to really finish the project properly.

Make a full-size schematic diagram of the circuit showing all parts and values, voltage and current, and the actual output at both jacks (use scope if available). A clear drawing of the parts layout will help if you ever have to work on yours. You may not remember it that well in time. You might even make a copy of this article for your service package.

Put all this in the file of service information you keep for your other gear. You do have one, don't you? Then it will be there when you need it. No guesswork.

This is one of the simpler pieces of test gear to use, but there are a few cautions I would like to stress.

If you have been used to working with transistor equipment, you may not be street-wise to the dangers of working in higher voltage tube circuits. This unit will help troubleshoot tube receivers and audio amplifiers, but make sure you observe all safety precautions for working with high voltage. Tube voltage levels are lethal.

Working with transistor equipment is a lot safer for you, but the oscillator has a husky output that easily can blow many transistor stages. Observe all safety precautions for working with transistor circuits, too.

As a general rule, set the controls of the unit under test as they would be for normal operation. Start with the lowest level signal you have and use the least signal that will do the job. You can damage a transistor stage with too much signal or even a static charge. It would be hard to damage a tube stage with this unit, but too much signal can cause distortion. You could be trying to fix a problem that you are causing while testing.

This unit will do a lot for you, but to use it safely and effectively you have to know what you are doing and why.

A good book or two on troubleshooting and repair will give you lots of ways to get the most out of your test equipment. Make sure your library covers both tube and solid-state gear.

A little hands-on experience working with this unit also will tell you a lot about its capabilities. ■

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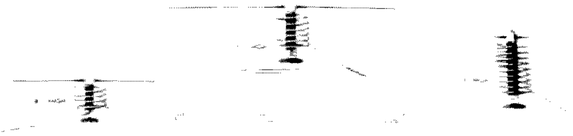

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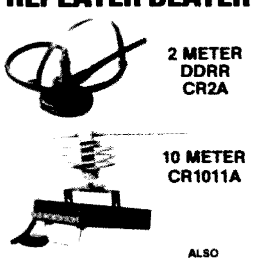
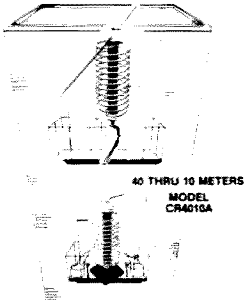


THE HI-RIZER



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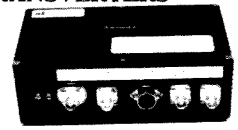

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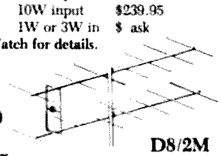

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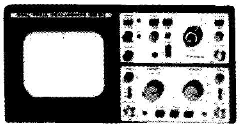

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Maximum Modulation for CB Conversions

Many CB rigs lack the gain for full modulation. This preamp will help.

If you have recently converted a CB for 10-meter operation or if your present ham rig has insufficient mike gain, you may be interested in building this simple microphone preamplifier. The majority of CB rigs in the lower to middle price ranges do not provide adequate mike gain for optimum modulation. Typical modulation levels obtained are from 30 to 60 percent. The addition of a preamplified mike can significantly increase the "talk power" of these rigs; just ask any CBer.

There are several commercially-available preamplified mikes on the market that will provide the added audio gain for a price tag of $25.00 to $50.00. A much cheaper alternative is the single field-effect transistor (FET) circuit shown in Fig. 1. I purchased all components for under $5.00 at a local Radio Shack store.

The circuit can be constructed in a separate mini-cabinet by using mating microphone connectors to match those used by your CB or it can be mounted inside the CB. When mounting within the CB, the additional mike connectors, switch, cabinet, and 9-volt battery are not required. You probably won't have enough room to install the potentiometer (R4) inside the CB, but it can be replaced with two fixed resistors once the proper mike gain adjustment level is established.

To provide similar circuit-operating parameters when installing inside a CB, substitute a 33k-Ohm resistor for R3 and connect it to a +12-volt power point in the CB. Also connect the common ground point of the preamplifier circuit to CB ground. Unsolder the existing microphone lead from the printed circuit board and connect it to the input of the FET circuit. Use a short piece of shielded wire to connect the output of the FET circuit to the printed circuit board and ground the shield to minimize hum pickup.

Adjustment is simply a matter of setting the potentiometer for optimum modulation level. This can be accomplished through the use of a modulation meter connected to the antenna feedline connector of the CB or during an actual QSO. Don't forget that the FCC limits the maximum permissible modulation level at 100 percent, so make sure that the gain setting used does not cause audio distortion or splatter.

When you have established the optimum level setting, the potentiometer can be replaced by two fixed resistors connected as a series voltage divider. To determine the proper resistor values, measure the resistance between the center lug of the potentiometer and each outside lug. Obtain two resistors having the same approximate values, connect them in series, and substitute these in place of the potentiometer. Connect the mike lead to the junction between the two resistors. Check that the resistors are installed in the circuit so that they have the same relationship as the measured resistance values on the potentiometer.

The circuit can be constructed on any suitable piece of insulating material. I used a piece of cardboard measuring about 1-1/2" by 3" and mounted the components on one half of the area. I then folded and taped the cardboard under to protect against possible shorting of the circuit connections. ■

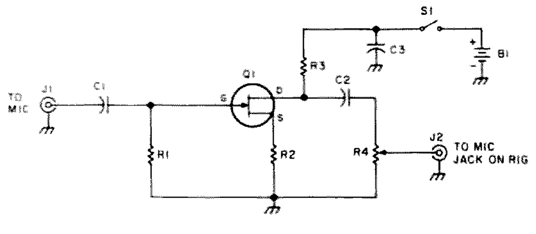


Fig. 1. Mike preamp circuit.

Parts List

B1—9-volt transistor radio battery
S1—SPST switch
Q1—FET, Radio Shack 276-2028
C1—0.01-μF capacitor
C2—0.1-μF mylar™ capacitor
C3—100-μF, 10-V-dc capacitor
R1—2-megohm, ½-Watt resistor
R2—3300-Ohm, ½-Watt resistor
R3—10k-Ohm, ½-Watt resistor
R4—50k-Ohm (or 100k) audio-taper potentiometer
J1,J2—Phone jacks to match equipment

CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73* Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*

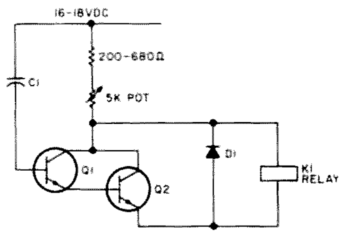


Fig. 1.

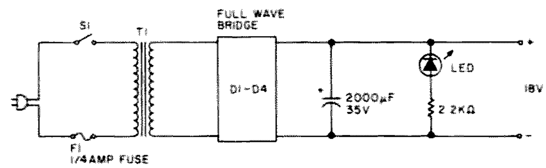
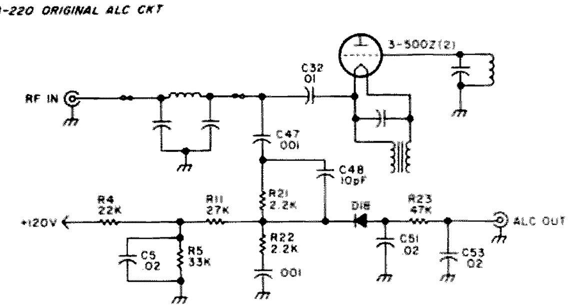


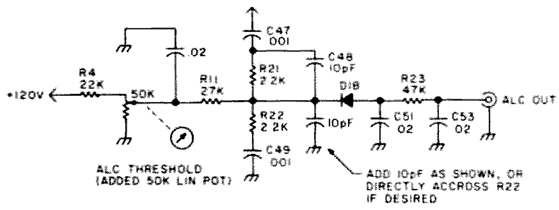
Fig. 2.

THE KEYLESS KEYER: This circuit can be used to key a transmitter with just a touch. In Fig. 1, Q1 and Q2 are any NPN transistors. C1 can be any disc capacitor. Make sure the leads are long enough so that you can touch them. When the leads are shorted by your finger, the small signal from your body makes the relay drop from 5 volts to less than one volt. The relay toggles. The SPDT leads of the relay can be used to key a transmitter. No dangerous voltages pass through the capacitor. Diode D1 suppresses any high inductive kickback and thus protects the transistors. Use either two 9-volt batteries in series or build the power supply shown. The LED and 2.2-kilohm resistor serve to indicate when the supply is on and to bleed off any dangerous voltages from the 2000-uF capacitor.—Alan Weinberg KR7D, Tucson AZ.

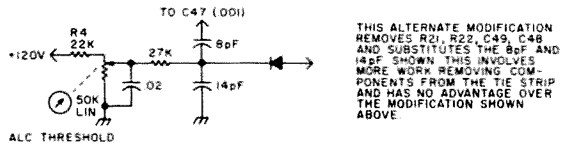
SB-220 ORIGINAL ALC CKT



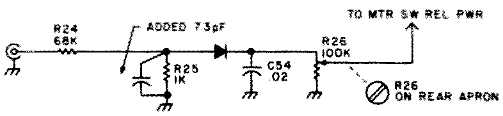
ALC THRESHOLD MOD



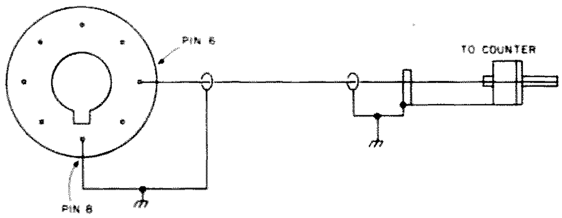
ALTERNATE MOD



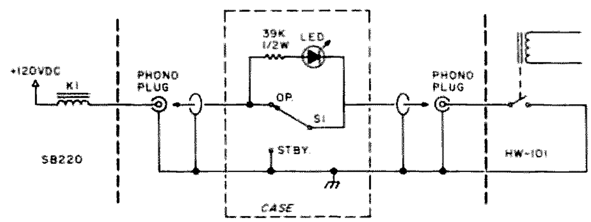
RELATIVE POWER METER CIRCUIT MOD



ALC MODIFICATION FOR THE HEATH SB-220: The ALC level in the Heath SB-220 is virtually unusable with the Collins 32S-3. This modification will provide an adjustable, stable ALC voltage for the SB-220. Install the ALC control in the front-panel position normally occupied by the Relative Power Sensitivity control. The RPS control is then installed on the left rear chassis apron about 4½ inches inboard from the left side. By adding a small capacitor across the R25, the response is made more uniform with respect to frequency. After modification, set the RPS to a reading of 270-280 measured on the grid milliameter.—E. A. Wingfield W5FD, Little Rock AR.



FREQUENCY ADJUSTMENT FOR THE YAESU FT-101: You can use an ordinary frequency counter to tell if your FT-101 is slightly off frequency. Pin 6 on the rig's accessory plug is connected to the vfo output, while pin 8 is ground. Connect a frequency counter to these two pins and check to see if the radio has the same frequency on transmit and receive. The counter will display the vfo frequency — between 8.7 and 9.2 MHz—not the frequency shown on the main dial. You can correct for any difference between the transmit and receive frequency by adjusting the control marked zero, located under the top cover.—Doc Hall W8ZJQ, Elyria OH.



OPERATE-STANDBY SWITCH: This circuit is ideal for a linear amplifier, such as the SB-220, which does not have a standby switch. The circuit requires only three components and a miniature box in which to house them. When S1 is in the OP mode, the 39-kilohm resistor and LED are shorted. Thus, when K1 is energized, the linear is on the air. In the STBY mode, the LED cathode is grounded and energizes. Selection of the resistor is critical: If too low a value, the relay will close in the STBY mode. The exciter can be tuned for maximum power with the antenna connected through the linear's bypass relay. S1 is then switched to OP and the linear can be loaded into the antenna.—F. T. Marcellino W3BYM, Rockville MD.

HAM HELP

I would like to obtain schematics or manuals for the following:

- E. F. Johnson "Ultracom" 30-50-MHz FM transceiver
- Tempo One 80-10-meter transceiver (the black version)
- Unimetrics "Dura-Scan" 30-50-MHz scanner
- Lafayette "Micro" P-50 30-50-MHz tunable FM receiver
- J. C. Penney model 6237A citizens band transceiver
- Kris model XL-70 citizens band transceiver
- International Crystal "Executive" model 1500 citizens band transceiver
- Heath HP-20 power supply

If copies are sent, please specify if they are to be returned or are for me to keep.

Gary B. Trustle WB8SPV
424 Franklin Ave.
Waverly OH 45690

I am looking for:

- Someone who has modified a Heath HD-1410 keyer for use with a Hallicrafters HT-37 transmitter.
- Firms who sell Motorola MV1404 tuning diodes; MAN-1, MAN-64, and MAN-6680 LED displays; and .25% to 1% precision resistors with values of 243k Ω, ¼ W, 11.2k Ω, ¼ W, 2.43k Ω, ¼ W, and 243 Ω, ¼ W. Since the resistors are special items, the firms must be able to conduct business with an individual buying very small quantities.

Paul Kemp WB0CJB
1025 E. Loula
Olathe KS 66061

I would like to find manuals or schematics for the following:

- AMPEX model CC323 TV camera
- AIL model R1283/GRC receiver
- AIL model IP805/GRC display
- Tektronix model 1401A spectrum analyzer
- Dumont model 1062 oscilloscope
- model DM10-12A0-16-A04 video display

Fred Wolf N5ARO
1920 Ridgelawn Dr.
Gautier MS 39552

I am looking for the instruction manual, service manual, and any modifications for the Tennelec Memoryscan MS-2. I also need the service manual and paperwork for the Motorola LO3GB transceiver. I will pay for postage and copying costs.

Mark Kiziuk N2DMI
2623 E. 11th St.
Brooklyn NY 11235

I need an Eico or similar VFO for a local Novice study group.

G. Samkofsky N4ZB
1420 Mt. Vernon Dr.
Holiday FL 33590

Wanted: drive belts for an Aiwa TP708 4" reel-to-reel tape recorder, as well as schematics and info on how to build a good communications receiver.

Derek H. Rout
3-137 Champion St.
Christchurch, New Zealand

Wanted: an external vfo for the Sears 412.35730600 2-meter FM rig or a schematic of it. I will pay postage for the schematic.

SSG Gary E. Kohtala DA2XF
USAFS-A Box 1415
APO NY 09458

I am looking for a Hunter Bandit linear amplifier.

Ray Warner W7JU/K7JU
2200 Jamaica Cove
Riviera AZ 86442

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SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received at 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458.

FARIBAULT MN
DEC 4

The annual Handi-Ham Winter Hamfest will be held on Saturday, December 4, 1982, at the Eagles Club, Faribault MN. Registration will start at 9:00 am, followed by a Handi-Ham equipment auction, dinner at noon, and a program. Talk-in on .19/.79. For more information, contact Don Franz W0FIT, 1114 Frank Avenue, Albert Lea MN 56007.

HAZEL PARK MI
DEC 5

The 17th annual Hazel Park Amateur Radio Club Swap and Shop will be held Sunday, Dec. 5, at Hazel Park High School, Hazel Park MI. Hazel Park High School is located on Hughes Street at 9½ Mile Rd., 1 mile east of I-75. Tickets are $1.50 in advance or $2.00 at the door. Tables are $1.00 per foot. Doors open at 8:00 am. Plenty of food and parking will be available. Talk-in on 146.52. For tickets, table reservations, and information, send an SASE to Hazel Park Amateur Radio Club, PO Box 368, Hazel Park MI 48030 or telephone (313) 398-3189.

SOUTH BEND IN
JAN 2

A hamfest swap & shop will be held on Sunday, January 2, 1983, at Century Center, downtown on US 33 One Way North between the St. Joseph Bank building and the river, South Bend IN. Tables are $3.00 each in a carpeted, half-acre room. The Industrial History Museum is in the same building. Four-lane highways lead to the door from all directions. Talk-in on .52/.52, .99/.39, .93/.33, .78/.18, .69/.09, 145.43, and 145.29. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616, or phone (219)-233-5307.

RICHMOND VA
JAN 16

The Richmond Amateur Telecommunications Society will hold Richmond Frostfest '83, the annual winter ham radio and computer show, on Sunday, January 16, 1983, at the state fairgrounds, Richmond VA. General admission is $4.00. All flea-market and commercial exhibit spaces will be indoors in a 30,000-square-foot exhibit building.

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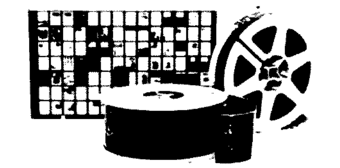

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RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

For the past few days, I have been reading a book that has struck a responsive chord within me. Detailing some of the goings on behind the scenes of my favorite radio show, National Public Radio's "All Things Considered," the book describes how the show starts with the rudimentary outline first laid out in a morning conference, goes through edits and revisions, and then bursts upon the public at 5:00 pm sounding fresh and spontaneous.

The reason for the empathy I feel is the way RTTY Loop falls together each month. For the December issue, for example, I usually try to take a look at items which could be given as gifts to the ham involved in RTTY or computers. "'tis the season," and all that. Several rough outlines are penciled in over the months until now, when I try to assemble an exciting column.

Well, yes, Maryland (Virginia is a bit to my south), there is a Serendipity. For just as I was casting around, looking for something novel or unique, what comes in the mail but a packet from Tom Harrington of Universal Electronics, Inc.

Tom, you may recall, is the gentleman who produced the book *World Press Service Frequencies*, a tome reviewed in RTTY Loop back in August, 1981. For those who came in late, I shall explain. This publication, now in its third edition, covers the full specs on over 65 stations transmitting press information worldwide in English. Also covered is information on antennas, terminal units, and the like. Well, Tom has a few more goodies up his sleeve. A giant *List of Worldwide Radioteletype Stations in Frequency Order* contains 2198 frequencies of stations logged this year. The frequency, callsign, name of station, ITU country symbol, times of reception, and details are included. Over eighty press and news agencies are listed, along with weather, military, and other services using RTTY.

Not to stop there, Tom has another rather unusual offering. Did you know that there is a five-level code for Arabic, Cyrillic, Hebrew, Greek, and Korean—not to mention a six-level Japanese code? If we throw in Hebrew, Arabic, Cyrillic, Greek, and Japanese Morse codes and then top it all with over 500 identified Arabic words and station names in RTTY, would you be interested? Well, Tom's new work, *List of Special RTTY and CW Alphabets and Codes*, has all this, plus quite a bit more. Write to Tom at Universal Electronics, Inc., 1280 Aida Drive, Dept. L, Reynoldsburg OH 43068. Use order code "R" for the *Worldwide Stations* list, $12; order "P" for the *Press Service* list, $8; and "X" for the *RTTY and CW Code* booklet, $8. Be sure to mention RTTY Loop in the order, too, OK?

Before we leave Universal Electronics, and while we are on the subject of gifts, I think I have something for the high-powered RTTY types among you. Their Universal M-600 RTTY code receiver may be the ultimate demodulator on the market. This unit decodes signals using bit inversion, TOR, SITOR, and nonstandard shifts. Weather as well as standard format is supported with all speeds of ASCII, Morse, and Murray. Output is both standard video as well as ASCII or Murray printers, complete with a printer buffer of 2K. This brief description only summarizes the material I have in hand. I am sure that Universal would love to send you the full details if you drop them a note at the above address. At $799.95, this is quite a package.

If that's too much money for you, but you are looking for an object in the "sizable but not ridiculous" category, have you considered one of the new small microcomputers? For under $300, you can buy an Atari 400 (which has some of the finest graphics I have ever seen and can be expanded to a full system including disk), the TI99/4 (sold in many retail outlets), a Radio Shack Color Computer, or (pushing under the $100 mark), the Sinclair ZX-81, now marketed by Timex and widely discounted. These and other small computers can serve either as a first system or, as my Atari does, as an intriguing second computer for someone already afflicted with the computer bug.

Computers aside, and I will admit that it is becoming harder these days to put them there, there are quite a few products around that appeal to the RTTY buff. I don't know about your wife, but mine enjoys window-shopping during the holiday sale season. How do you window shop in a magazine? You look at the ads! Let's see what is available, right here in the pages of *73*. I must point out that information I have on some of these items is from literature or the advertisements themselves. If you want more details, write to the company, not to me. By the way, I recognize that many products covering a wide range are of interest to the amateur involved in RTTY, but let's look only at specific RTTY items. If you will follow me around the next corner...

I see that RCA is selling off old, used ASR-33 teleprinters. This is a usable terminal for ASCII circuits and would make a reasonable first start for the amateur interested in getting onto ASCII RTTY. We have covered the hookup of the ASR-33 in past RTTY Loops, and many hams have them on the air. Supporting uppercase ASCII only, these 110-baud machines include punched paper tape facilities. At $300, the price may be above what you would pay at a hamfest, but I presume the units are checked out and working. If you are interested, contact J. H. Bell at the RCA Service Company, Bldg. 204-2, Route 38, Cherry Hill NJ 08358.

Going from the earliest to one of the latest, Kantronics offers their "The Interface." For about $190, this box, plus software available separately, will put many popular microcomputers onto RTTY. Software for the Apple II computer is supplied on a diskette for about $30. Program boards, presumably containing ROMs, are available for the Atari 400/800 or VIC-20 for $50, or for the TRS-80C Color Computer for $60. Drop a line to Kantronics at 1202 E. 23rd Street, Lawrence KS 66044, for details.

Producing a fine stand-alone terminal, our old friend Microlog, located at 18713 Mooney Drive, Gaithersburg MD 20879 (just north of Washington DC), is still turning out their 6800-based systems. The ATR-6800, reviewed in this column some time back, is an expandable system which can be turned into a general purpose computer. Their newer ACT-1 (not to be confused with a simple computer terminal of the same name available a few years ago) is a dedicated RTTY/CW/SSTV computer. Both use the Motorola 6800 CPU, of which you all know I am quite fond, and appear to be very well engineered. The ACT-1 is a shade under $1000; I don't have a recent price on the ATR 6800. I'm sure the guys at Microlog would be happy to fill you in.

Another way to get onto computerized RTTY is with a package offered by Tufts Electronics, 61 Lowell Road, Hudson NH 03051. The experts up there will sell you the Kantronics interface detailed above, with a VIC-20 computer, cables, speaker, and instructions for the package price of $499, as of this writing. Sounds like it might be worth a peek.

Another advertised system is the MFJ Super Keyboard. This box operates on CW, Murray, ASCII, and as a memory keyer and Morse practice machine. Two versions are available. The MFJ-494 features a 50-character buffer, 30-character memory, and automatic messages, and sells for about $280. For another $60, the MFJ-496 increases the buffer and message memory to 256 characters each and adds serial numbering and a repeat message function. Options of AFSK keying, loop keying, and clock module are also available. Drop MFJ Enterprises, Inc., a letter at Box 494, Mississippi State MS 39762, if you would like further information.

We can't forget our old friends iRL at 700 Taylor Road, Columbus OH 43230. Their two converters, the FSK-1000 and FSK-500 (reviewed in this column in the past), remain excellent products. They also tell me that they can interface their terminal units to many popular computer systems. Just ask them a question—they say they have the answer.

A common question in the mail has been whether there is an adapter made just for the TRS-80C Color Computer for RTTY. Well, Ridge Systems Co., Inc., is advertising their 4511 RTTY Interface. Selling for about $170, this ROM board supports Murray and ASCII, a split screen, and messages stored to cassette tape. Drop them a note at PO Box 772, Acton MA 01720, for more information.

Xitek, one of the first companies out with a single-board terminal, is still featuring their SCT-100 ASCII/Murray terminal. Listing at $229, it may be of interest to some of you. Their mailing address is PO Box 2952, Garland TX 75041.

Speaking of originals, Macrotronics, Inc., 1125 N. Golden State Blvd., Turlock CA 95380, was one of the first with interfacing to microcomputers. Their "TERMINALL" is a hardware/software system for the Apple II or TRS-80 (Model I or III) that combines terminal unit, computer interface, and bells and whistles into one neat package. For about $500, this is quite a system, supporting ASCII, Murray, or Morse.

Another computer interface, the ROM-116, is available from Crown MicroProducts, 606 State Street, PO Box 892-R, Marysville WA 98270. This package requires an external terminal unit and includes facilities to save text to disk along with other features similar to other systems. Write Crown for a brochure and pricing details.

The TRS-80 remains the most often supported computer for the RTTY interface, with another one offered by Commtek. Their Contact-80 is available for Model III disk or tape systems, selling for $279 or $229, respectively. With split screens, canned messages, date and time, and identifiers from the computer, this looks like a versatile package. Write them at 4493 Orleans Drive, Dunwoody GA 30338, if you are interested.

Another item we will look at in the window-shopping tour is a window in itself. AEA's MBA-RC reader/code converter. This decodes Morse, Murray, or ASCII and displays the data on a 32-character internal display. Not only that, but it can convert between codes, so that an old Murray machine could speak ASCII or Morse on the air. Looks quite interesting, and full details are available from the manufacturer, Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036.

Last, but not least—by any means—is old standby Hal Communications, whose name is almost synonymous with RTTY. You have a complete choice of station accessories and options... enough to build a complete RTTY system or any part of it. For example, the HAL DS3100ASR and ST6000, when combined with the MS03100 Message Storage Option and a hard-copy printer, give you a top-notch station. If you're not prepared at this time to spend all your money on a complete layout, what about the RTTY tuning scope? HAL's RS2100 gives you an accurate display of the signal amplitude and phase of the received signal and a flock of other internal goodies. If you're a travelin' man, you'd like the HAL CWR-6850 Telereader... the smallest RTTY and CW terminal available, according to their specs, and complete with CRT display screen. Communicate with Hal Communications at PO Box 365, Urbana IL 61801.

You know, I often say to mention both *73* and RTTY Loop when you write an advertiser for information or to order something. Let me tell you why. This is not just to toot our own horns. Advertisers spend thousands of dollars putting their name and product before you in various media. They want to know which ones work, and where you hear of them, so that they can better direct future campaigns. The better directed the ads, the less "wasted" money, and the more that can go into better products for you and me. So, you see, telling them that you "saw it in *73*'s RTTY Loop column" is a wise move.

Still stumped for a gift? How about the one that comes a dozen times a year? Less than twenty bucks will get you a one-year subscription to *73*, the magazine that brings the active ham so much more of what you read magazines for. Besides, you wouldn't want to miss the next installment of RTTY Loop, would you?

HAM HELP

I am a wheelchair-bound amateur in need of equipment capable of working the MARS two- and six-meter bands. Please telephone me at (417)-561-4685 or write me.

Edward L. Maranville KA9COJ/AAT7GX
PO Box 512
Rockaway Beach MO 65740

I need a schematic and manual for a Hallicrafters CRX-2 (152-174 MHz) receiver. Any information will be sincerely appreciated. I will pay all costs involved, but please advise me of same first.

L. E. Taylor K9REB
Box 420
Mount Prospect IL 60056

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

HAM GEOGRAPHY

I'm always amazed at the average ham's grasp of geography. As if it weren't enough that most of us are already experts on electronic theory, radio propagation, and telegraphy, we can also claim a knowledge of virtually every square inch of this tired old planet's surface. Who else but a ham is intimately acquainted with such places as East and West Kiribati, Bajo Nuevo, Bouvet, and Chagos? When Great Britain and Argentina began fighting over a forsaken bit of territory known as the Falkland Islands, most of the world ran for an atlas. For hams, VP8-land was an old friend.

This month, Fun! tackles the field of ham geography. Think you know it all? Read on.

ELEMENT 1—CROSSWORD PUZZLE

(Illustration 1)

Across

1) G-land (2 words)
7) From
8) Eastern European land
11) Western state (abbr.)
12) New England state (abbr.)
13) Austria prefix
14) African country
16) To borrow
17) Agency involved in extreme DX (abbr.)
18) Arab country
21) Xmas in France
22) Type of power measurement (abbr.)
24) China (abbr.)
25) 49th state (abbr.)
26) This column
27) Vermont flow product
28) Ø-land state (abbr.)
29) Green Mountain State (abbr.)
31) Soviet prefix
33) Midwest state (2 words)

Down

1) DL-land
2) Southern state (abbr.)
3) African country (abbr.)
4) Far East country (abbr.)
5) A ham radio commercial (abbr.)
6) Belonging to a group of northern states (2 words)
9) Face or type of cup
10) EP-land
13) Peru prefix
15) 6 down district number
19) EI-land
20) US York and Orleans
23) ___ ___ New Guinea
26) ___ ___ Lauderdale
29) India prefix
30) Chad prefix
32) Australia prefix

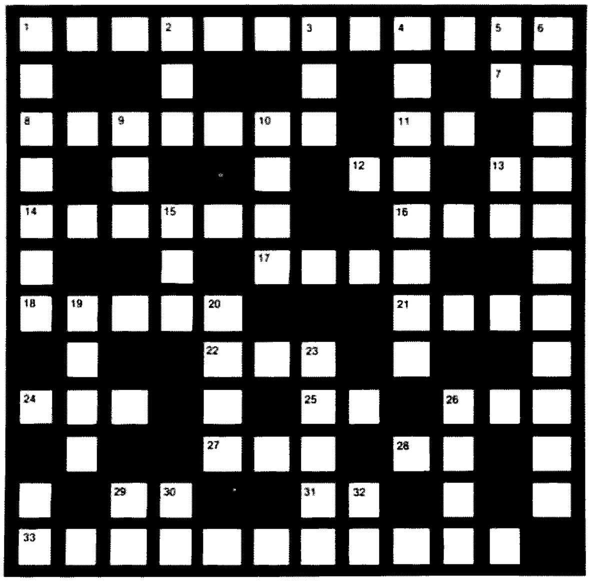


Illustration 1.

ELEMENT 2—MATCHING

Sure, you know all sorts of rare countries by prefix. But do you know their capital cities? Master this subject, and surprise your friend in Paraguay by asking him how things are doing in downtown Asuncion.

Column A	Column B
1) Malta	A) Bogota
2) Bulgaria	B) Reykjavik
3) Romania	C) Manila
4) Nepal	D) Tripoli
5) Maldives	E) Nicosia
6) Bhutan	F) Rangoon
7) Burma	G) Caracas
8) Philippines	H) Katmandu

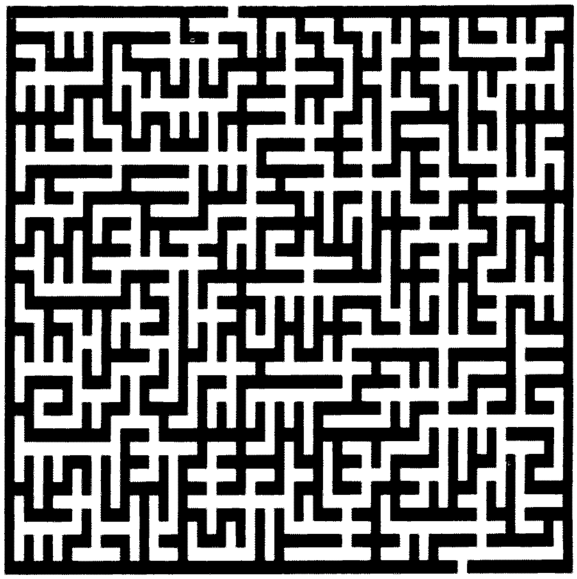
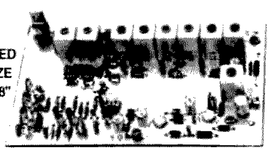


Illustration 2.

Hi Pro LB-VHF-UHF REPEATERS SOON TO BE FCC TYPE ACCEPTED

Hi Pro RECEIVER AND TRANSMITTER NOW USED IN ALL HI PRO REPEATERS

ASSEMBLED SMALL SIZE 3 7/8 × 6 1/8"



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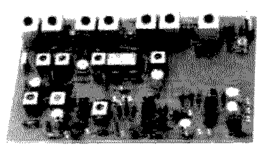

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✓See List of Advertisers on page 130

9) Indonesia	I) Baghdad
10) Australia	J) Lagos
11) Algeria	K) Luanda
12) Senegal	L) Islamabad
13) Nigeria	M) Sofia
14) Libya	N) Suva
15) Sudan	O) Paramaribo
16) Angola	P) Djakarta
17) Venezuela	Q) Khartoum
18) Colombia	R) Valletta
19) Cyprus	S) Dakar
20) Turkey	T) Algiers
21) Iceland	U) Bucharest
22) Iraq	V) Thimphu
23) Pakistan	W) Ankara
24) Fiji	X) Canberra
25) Surinam	Y) Male

ELEMENT 3—TRUE-FALSE

	True	False
1) In 1977, the president of the Comoros (D6) had every dog in his capital city of Moroni killed.	______	______
2) North Yemen (4W) used to be known as Aden.	______	______
3) The movie *The King and I* is banned in Thailand (HS).	______	______
4) In Tanzania (5H), wearing a wig is punishable by flogging.	______	______
5) When visiting Nepal (9N), one can stop in government-approved hashish stores.	______	______
6) Timbuktu is located in Mali (TZ).	______	______
7) Half of the population of Kenya (5Z), is less than 16 years old.	______	______
8) Paraguay (ZP) is the only country with two faces to its flag.	______	______
9) In South Africa (ZS), only whites may hold ham tickets.	______	______
10) Dueling is legal in Uruguay (CX).	______	______

ELEMENT 4—MAZE

(Illustration 2)

You know, ham radio is a lot like a maze. Thousands of frequencies, dozens of modes, hundreds of antenna types—it can all get very confusing. Here's a much simpler maze. All it requires is a pencil and some time. No money or physical effort is needed. Thanks go to my Radio Shack TRS-80 Model II for creating it.

THE ANSWERS

Element 1: See Illustration 1A.

Element 2: 1-R, 2-M, 3-U, 4-H, 5-Y, 6-V, 7-F, 8-C, 9-P, 10-X, 11-T, 12-S, 13-J, 14-D, 15-Q, 16-K, 17-G, 18-A, 19-E, 20-W, 21-B, 22-I, 23-L, 24-N, 25-O.

Element 3:
1—False At his witch doctor's request.
2—False No, that was South Yemen.
3—True They believe the film presents a false view of their history. No Yul.
4—True Yul.
5—True Mount Everest ain't the only thing high in Nepal.
6—True Once a great city, it's now a town of about 6,000.
7—True Thanks to a very high mortality rate.
8—True Boon to flag manufacturers.
9—False Not officially, but what's the difference?
10—True Great way to settle frequency disputes.

Element 4: See Illustration 2A.

SCORING

Element 1: Twenty-five points for the completed puzzle or one-half point for each question correctly answered.
Element 2: One point for each correct answer.
Element 3: Two and one-half points for each correct answer.
Element 4: Twenty-five points for the completed puzzle.

How worldly are you?

1-20 points—Hermit
21-40 points—Recluse
41-60 points—Know where your area repeater is located
61-80 points—Armchair traveler
81-100 + points—Man of the World

Illustration 1A.

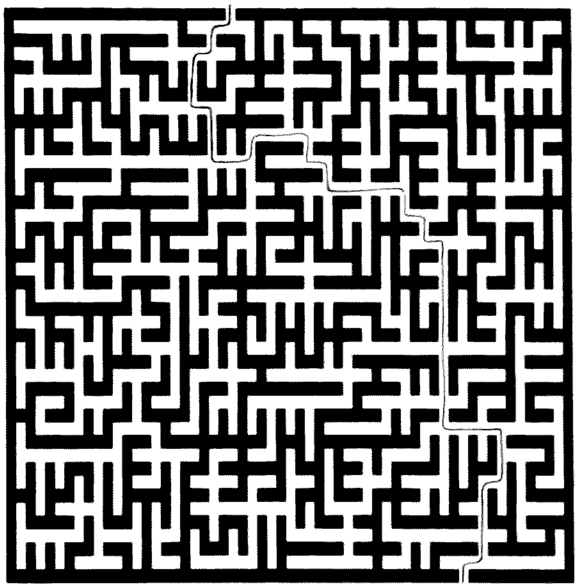

Illustration 2A.

LETTERS

TALK FAST

While reading your response to W6EOT's letter in the September issue it dawned on me just why the "already-known techniques" for high-speed communication are not used in the ham bands.

You say we can communicate at 8,500 words per minute using these techniques. That would be great for traffic handlers (of which W6EOT is one) and maybe contesters if one could figure out how to program the system to be fast enough. One could conceivably work two or three thousand stations per minute!

However, you often expand on how nice good old rag chewing is. I can't understand how you propose to rag chew at 8500 wpm!

Some simple testing of my talking speed netted only 235 wpm. I sure can't talk coherently or even think at 1000 wpm, much less 8500 wpm!

Therefore, to communicate at 8500 wpm, I would have to preprogram some device at my own speed (say 200-400 wpm), contact another station, and punch the proper button to transmit my message at 8500 wpm. I could no doubt say everything on my mind at the time in less than thirty seconds, if I had 4000 words to say.

The other station's reply would then be transmitted to me at 8500 wpm, but I would have several minutes to wait while he programmed reply comments into his "super QRQ box." And, of course, he would have several minutes to wait for my next round of comments.

The fact that actual transmission time is

very small and more stations can use the available spectrum is a nice idea but needs some human engineering, namely, a QRQ to QRS receive converter that would convert the high-speed transmission to normal talking speed with a voice synthesizer, either synced to the other station's voice tones or to a pleasing blonde (for OMs) or tall, dark, and handsome buck (for YLs).

The transmit converter would take a few dozen words spoken into the microphone and blip-transmit them at 8500 wpm, take a few dozen more and blip, and so on.

The receive converter takes the 8500-wpm transmission and begins "talking" to the receive operator at 200 or so wpm (adjustable of course).

And there you have a high-speed system compatible with us relatively slow humans.

Dennis Younker NE6I
Lancaster CA

So what's the difference if your transmitter is on the air, keeping anyone else from using a channel while you mumble inconsequentials at 200 words per minute? Why not have your processor save all that garbage up, put it into a compactor, and dump it at 8500 wpm? Then a bunch of other people could use the same channel. Dunno why we're talking about voice anyway . . . unless all of the code lovers have suddenly died. There are still a few old-time hams around, graduates of early American schools where reading and writing were taught. We could consider opening up classes in our ham clubs on the first two Rs so newcomers could cope with code and printed types of communications.—Wayne.

LETTER ACCELERATION

For some time I have been practicing CW just for the fun of it, as in the HK zone, code is required only for the first-class license.

When getting on the air I find many Novices eager to make the HK contact. They go at my speed when they are calling CQ, but surprise, surprise, once they get to their own callsign, their speed increases by several words per minute, so even if I know that they would immediately answer when they hear the HK coming back to their CQ call, I am not able to call them. Maybe you could write something about this in your magazine.

I usually try to answer CQ calls because when I call CQ with my HK there are just too many stations who come back on my call, even if I sign the HK only once.

I intend to keep you posted on my adventures in CW land.

Rudolf Aumann HK1ESU
Cartagena, Colombia

TOPFSHUTTLER?

My grandmother would say you are a Topfshuttler—a pot stirrer. Isn't that just what an editor is supposed to do? Make people think! You do that well. Obviously, you allow your writers the same freedom.

73's view from Olympus must be a heady one. However, the view is occasionally obscured. Could it be from too much looking down the nose at mortal hams?

A case in point is John Edwards' comment in his column in the July issue, page 123. Commenting on his question, "Do you own a microcomputer?" he stated, "I can't see how a technically-inclined person can be without one." That is editorial nailbuffing from a have to the have-nots and is anything but constructive.

Wayne, please tell the lesser gods at *73* that it ain't 'xactly necessary to have a microcomputer or the latest flamethrower from Japan in order to have fun (and fulfill our responsibilities under Part 97). Yes, *73* should tell us what is new and keep us up to date. But, too often, you promote the idea that the ham should be measured by his equipment when the equipment should be measured by the ham.

Robert F. Solon WD8LKI
Toledo OH

Never let it be said that I interfered with your inalienable right to be totally, thoroughly, ridiculously wrong.—Wayne.

WHAT'S THE FUSS?

You all wanted more teenagers in ham radio? Here I am! I'm 15 years old and just received my Tech ticket. I skipped the Novice test and was really surprised at how simple the FCC exam was. I finished my first year of electronics in high school, which provided all the theory I needed to know, but I had to learn Morse code on my own. I don't know what the big fuss is over learning Morse code. Anyone can do it. Even with the end of the school year approaching and final exams just around the corner, I was able to find time to study code. Everywhere I went I carried a set of phonetic flash cards with me. When I would finish an assignment in class, I would pull out my cards and study a group of letters. I even found time to study during my Spanish final exam! Nobody can use the excuse: "I just don't have the time to study code."

It took me two months before I was ready for the FCC code test. After I took the code test I continued to study Morse code. Within two days I was up to 13 wpm. It kind of made me wish I had held out one more week to take the General code test. I do plan to update to General or Advanced sometime in the near future.

I remember reading a letter in which someone said that the high price of ham gear was keeping kids out of the hobby. I say that is 100% untrue. I agree that prices these days are a little steep, but you do not have to own gear to be a ham. My ham shack consists of a DX-302 receiver and several dipole antennas. My school has a transmitter/receiver combination but we do not have a ham radio club, so I cannot use the equipment. I do plan on starting a club at school but that will take some time. In the meantime, I am asking any ham in the Springfield, Va., area to get in touch with me at 455-1490; I'm dying to get on the air.

I would like to thank the hams who work 3999 kHz at night. I never miss a night listening to this frequency. The more I listened to these fellows, the more I wanted to get my license. Unfortunately, I can't tell them this because I cannot work 75-meter phone. Oh well, this just gives me more incentive to update to Advanced.

Jim Jones N4HQC
Burke VA

STILL BUILDING

Having been involved in ham radio for half a century, I look back at what ham radio was and what it is today.

In the "Good Old Days," the talk during a QSO was largely technical, dealing with home-made projects. Traffic was handled in an era when telephones were considered a luxury. Parts for your favorite projects were always available at "downtown" distributors. A less affluent society made hams more ingenious in their needs.

Today's QSOs are far different! Each new contact allows the ham to list his Japanese-made appliances as if owning a $3,000 layout reflected on his technical ability. But let a transistor or IC go bad, and the appliance is quickly returned to a "repair depot."

The irony is also that, even for those few hams who can handle difficult repairs, manuals for said appliances lack sufficient information or cost fairly large amounts of money!

It is indeed fortunate for current hams that *73 Magazine* is alive and kicking today! For myself, now 65 and retired, the many construction articles have given me many enjoyable evenings. At the same time, local newcomers (age 12-80) likewise were able to discover the "joys of building" via *73*.

Perhaps many readers may disagree with my viewpoints, but I bet the old-timers who remember building a Bearcat receiver or a 47-46-46 push-pull transmitter will agree, the golden years of hamming are past.

Gerald Samkofsky N4ZB
Holiday FL

Oh, guano, Gerald. I started in 1938 and I visited every active ham I could find. They were a bunch of turkeys, just like today. Nothing has changed except your memory. Remember that the first ham contact with Europe was made by a pirate and we never found out who it was. If you've read any 30s ham magazines (or still survive those days) you know that QRM is no better today than it was fifty years ago. Yeah, the old-timers did build, but they didn't know what the hell they were doing and as often as not blew out the filaments by hooking them to the plate voltage. Gerald, I get on 20m and talk with DX that wasn't even imagined 50 years ago and I do it without a lot of trouble. I had a 20-minute contact this morning with a chap in Apia, Western Samoa . . . then a shorter one with a chap in Colombo, Ceylon . . . followed by a nice long chat with HS1ALV. We've never in the history of ham radio had it this good!—Wayne.

DESTINATED

After a few years of operating K1OIQ/R at the summit of Mount Washington, and then this recent summer of traveling about the countryside, I have the following observations and comments to make. This letter was originally a reply to one that I received after criticizing a fellow's operating habits. I would like to give this opinion wider coverage, as it is meant for the entire amateur community.

I apologize only for the way I sometimes come across; tact is one of the things I am still learning. Really, Bill, those of us here are not trying to impose "custom" on anyone's operating habits. Some of it is rather complex—some, kind of stupid I suppose; but I would like very much to get a cheery reply when I call CQ, CQ, rather than some jerk's admonishment: "That's not the way we do it on this repeater." No logic, no conversation, just "that's not the way . . ." Here, at least you get some logic, advice, and conversation as well.

I submit that most hams, like most of the public, are being Madison Aved into an abortion of the language. I am not opposed to such a word as "destinated" (though I hear from a lot who are). I don't know of a shorter, more to the point way of saying, "I'm at to where I'm goin'." The coining of such new words is how our language grows; some day Mr. Webster may even include it in his book. However, I do object to the misuse of language (words and grammar), the sometimes cliquish use of words and phrases, the double question to which one can always answer yes and/or no and still be right, and the long-winded, nonstop monolog method of two-meter operation when, as I think, it should be more like face to face (eyeball, hi hi) or telephone like. Not to mention the editorial we—and the sometimes never ending ID.

Now that I've got this started I shall continue (might even send this in to my friend Wayne Green, hi hi—I might even write a book).

Handel (?) . . . no, I think that's supposed to be handle . . . yes that's better; "handle" is bad enough . . . is for pots . . . is made of wood . . . the vandals stole my handles so I have to use my name (hope you don't mind) . . . Have you been asked for your "personal"? ". . . the personal here is . . ." "What's a personal?" said I in reply; and the new ham apologized for having been a CBer. "No apology expected nor required," I said. "Some of my best friends used to be CBers; a lot of us have taken that same promotion. No ham shack is complete if it doesn't have a working CB radio. But let us try speaking English here, not some silly dialect."

And then there is the editorial we. *We* did this and *We* did that and *We* are going and *We* are using . . . I was listening in one day (needless to say I've got LISTENERS NET LISTENING CERTIFICATE #1) when a friend of mine replied to one of those we-we-we monologs by saying how it was ". . . so wonderful that you and your wife can do everything together . . ." The we didn't even respond. What ever happened to I? Is it taboo or something to say "I did this . . ."?

And the never ending ID. Bad enough again, what with ID required only once every ten minutes, that two hams will ID back and forth after every speech . . .

". . . WWW this is ZXC and back to you before I time this thing out. Ya ZXC this is WWW fine business . . . blah blah and OK on this, that, and the other thing . . . ZXC this is WWW. OK WWW, ZXC right back . . ." and on it goes. But when there are four or five of 'em and each one has to say the calls, in proper turn mind you, they spend more time blowing all the horns than they do in any meaningful conversation.

SO! if one wants to "listen" or "monitor," calling out and announcing same once a day should be sufficient. Also, I feel it should be a "custom" that one who has previously announced that he is "listening" should announce "not listening" when not.

ABC signed on "listening." A minute or so later ZXC announced he was "listening." ABC "listened" again a short time later and before the tail dropped, ZXC "listened" a little louder. Finally, after a pregnant pause, ABC *called* ZXC and the usual ". . . fine business, nice to meet you, hope to see you further on down the log . . ." QSO followed. Now tell me Bill, was that a "customary initiation of QSO" or was that a "power struggle"?

If what one really wants is to QSO, then I respectfully submit that what one should do is call. Call, as in CQ, CQ. Or, if that is too straightforward and meaningful, then at least something like "Hullo radio! . . ."

In this arena I am not concerned with custom; I am not trying to promote any particular way over any other way; I merely want people to say what they mean, be concise, and not be afraid to say "I" once in a while so that when they say "we" you'll *know* there is more than one of them.

However, I'll turn right around and fall back on custom when it comes to badmouthing the shortcomings of the tourists. I know it is the tourist money that "helps keep New Hampshire green." But I also

NEMAL ELECTRONICS

COAXIAL CABLE SALE

This Month's Specials

Same Day Shipping

RG8U-20 ft., PL-259 ea. end $4.95
RG214U dbl silver shield, 50 ohm .... $1.35/ft.
100 ft. RG8U with PL-259 on each end $19.95
BELDEN Coax in 100 ft. rolls
RG58U #9201 .... $11.95
Grounding strap, heavy duty tubular braid
3/16 in. tinned copper .... 10¢/ft.
3/8 in. tinned copper .... 30¢/ft.

POLYETHYLENE DIELECTRIC

RG213 noncontaminating 95% sheild mil spec .... **36¢/ft.**
RG174/U mil spec. 96% shield .... **10¢/ft.**
RG11U 96% shield, 75-ohm mil spec .... **25¢/ft.**
RG8U 96% shield, mil spec .... **$27.95/100 ft. or 31¢/ft.**
RG6A/U double shield, 75-ohm .... **25¢/ft.**
RG58AU stranded mil spec .... **12¢/ft.**
RG58 mil spec. 96% shield .... **11¢/ft**

LOW LOSS FOAM DIELECTRIC

RG8X 95% shield (black, white or gray) .... **$14.95/100 ft. 17¢/ft.**
RG8U 80% shield .... **18¢/ft.**
RG58U 80% shield .... **07¢/ft.**
RG58U 95% shield .... **10¢/ft.**
RG59U 100% foil shield, TV type .... **$7/100 ft. 10¢/ft.**
RG8U 97% shield 11 ga. (equiv. Belden 8214) .... **31¢/ft.**
Rotor Cable 8-con. 2-18 ga. 6-22 ga .... **19¢/ft.**

CONNECTORS MADE IN USA

Amphenol Pl-259 .... **79¢**
PL-259 push-on adapter shell .... **10/$3.89**
PL-259 & SO-239 .... **10/$5.89**
Double Male Connector **$1.79**
PL-258 Double Female Connector .... **98¢**
1 ft. patch cord w/RCA type plugs each end .... **3/$1.00**
Reducer UG-175 or 176 .... **10/$1.99**
UG-255 (PL-259 to BNC) **$3.50**
Elbow (M359) **$1.79**
F59A (TV type) .... **10/$2.15**
UG 21D/U Amphenol Type N Male for RG8 .... **$3.00**
BNC UG88C/U, male **$1.25**
3/16 inch Mike Plug for Collins etc **$1.25**
UG273 BNC to PL-259 .... $3.00

FREE CATALOG
COD'add $1.50—FLA. Res. add 5% Sales Tax

Connectors—shipping 10% add'l, 2.50 minimum ✓412

Cable—shipping $3.00 1st 100 ft., $2.00 each add'l 100 ft.

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know what it is to be a tourist . . . and hear all the speed demons from Massachusetts griping about being behind a slow-moving farmer.

I censor neither what nor who gets talked about on this repeater. I encourage and even incite lively debate. It seems to me that most of the folk on the receiving end of these barbs are so serious and uptight about their inanities that they fail to see the humor in a serious debate.

If only I could run the repeater on all this hot air.

Al Oxton K1OIQ
Mount Washington NH

Feel better now?—Wayne.

THE $1.98 LICENSE

I just finished reading the code vs. no-code gangfight letters in the October issue. Frankly, I felt like throwing up. Such lack of imagination; such lack of perception. What we need is negotiation. You know what negotiation is: that's where them what have agree to give all or part of it away in return for return of a hostage, or not getting their heads busted, etc.

In the spirit of negotiation, let me suggest that no one has tried to unite all the factions of this argument by proposing an amateur radio licensing program with something for everyone. Let me then address it from that standpoint.

First, we need to set a goal; hell, anyone familiar with success can tell you that you must establish a goal. The goal must be reasonable—one you can expect to be able to fulfill by a certain time.

Amateur radio's goal then should be to find the method by which everyone will be licensed within 3 years . . . Change that: everyone who wants to be a ham; we don't want anyone bitching about how we forced him or her to become a ham.

I hear it already: someone saying, "Where would we put them all?" We have literally millions of amateur radio frequencies which are relatively unused. No one said everybody had to be on 20 meters.

The reason for not proposing to include any life forms in other galaxies is twofold. First, it is unreasonable, and the goal must be kept reasonable to be feasible. Second, although the life form known as "slime" must be integrated into amateur radio if we are to meet our goal (a belief in the "inherent goodness of man" being implicit), we do not know whether or not we would want to share our frequencies with other life forms. Between slime and upright man, we should be able to bring enough hams into amateur radio to make it worthwhile for manufacturers and others with pecuniary interests, thereby assuring the future of our bands.

It thus being established that our goal should be to make available an amateur radio operator's license to anyone and everyone who desires one within 3 years, let's look at how to accomplish our goal.

First, the US should lead the way and show the rest of the world how it's done. Wayne Green has stated many times that the FCC has stifled the growth of amateur radio here. Anyone familiar with the doldrums which followed the incentive licensing system imposed back in the 60s should require no further proof. Anyone, though, who needs more proof as to whether or not the FCC should administer the amateur radio service, is reminded of the Citizens Band class-D service and the monumental FCC mismanagement there. Clearly, we do not need the FCC, and responsibility for amateur radio management should be moved to the private sector. More recommendations on that later.

The big hang-up seems to be inflexibility by all parties. I would remind you, if you admit you are inflexible, that when it became apparent Johnny could not read, rather than universities going out of business they provided new innovation. Their goal remained unchanged: to pass out the degrees. Only the requirements changed. Rather than being compelled to submit to remedial reading classes, colleges gave credits for music appreciation, penny pitching, ant watching, etc. This innovation, coupled with sports scholarships and the introduction of new specialties in the liberal arts, kept the degrees flowing. It didn't do a damn thing about Johnny's reading difficulty, nor technically staying ahead of the Russians, but the universities remained open.

US hams are accustomed now to the multiple-choice examination style. Our solution lies in going a step further. We should allow the amateur radio aspirant the greatest possible latitude in the entry requirements for our fraternity, within certain reasonable limits necessary to protect the integrity of amateur radio, lest someone succeed in obtaining a license for his dog, etc. There is enough bitching without that. An either-or testing format would allow the aspirant to choose only subjects they feel confident in.

As an example: Code is a requirement for the HF bands, but, as letter writer Roger E. Berube points out in the October *73*, code is our link to nostalgia. Machines can now send and receive code, usually faster and cleaner than humans. If an inability to learn code is the only obstacle keeping out an aspirant, then he should be allowed to demonstrate some other skill in lieu of sending and receiving code by hand. Perhaps he is a skilled typist, or could learn to type easier than he could learn to copy code. If so, he should be allowed to appear for testing with his computer keyboard and digital code readout under his arm. Provided he successfully operates his machinery and has ample reading skills, he should pass the code test without investing in the *73 Magazine* code tapes.

We could also simply fail to honor our commitment to ITU and drop the code requirement, as some countries do, upon demonstration that the aspirant has finely tuned his "money" skills. An aspirant with money should be permitted to substitute money for code skill. This would just be a liberalization of a policy popular in the Third World . . . or perhaps there is some other explanation why many of their phone (or phony) ops clutter up the bands which gentlemen have long reserved for CW only, ending each sentence with "Roger, QSL?" and refer to the CW underneath them as "portadoras" (carriers?). *Alguien nos esta poniendo una portadora* . . . Roger, QSL? (Someone is putting a carrier on us, Roger, QSL?)

The Roger, QSL? kind of operator, when allowed a reciprocal license to operate in the US, is the subject of considerable anguish at the FCC, which threatens to stop third-party traffic for all reciprocal licensees (if not all US hams). Further evidence that the FCC should not be involved in administering amateur radio! Our fraternity should be turned over to the private sector for administration and the second step after the abolishment of code should be to strike out the requirement that amateur radio communications be noncommercial. No other aspect of amateur radio is noncommercial; why shouldn't we allow tow-truck dispatchers to use it and foreign visitors to conduct their financial dealings via amateur radio? Nets could even be set up to allow hams to manage their stock transactions right on ham radio, since eventually our goal is to license everyone on Wall Street as well.

People are basically good; everyone will behave himself or herself. Remember that if they won't, we can just legalize the offense.

Or, perhaps the trouble is not with the code at all, but with the theory, or the rules. We can be flexible here as well. If a person can copy 20 wpm, but can neither read nor write coherently and without moving his lips, he should not be denied access to an amateur radio license so he may participate in our fraternal brotherhood. In lieu of a theory or rules examination, he should be permitted to demonstrate some other skill, or possess money. Such substitute skills should of course be radio-related: wire splicing, tube replacement, etc.

Now the big question about who should replace the FCC in administering amateur radio. If the job were turned over to the ARRL, then *Ham Radio*, *73 Magazine*, and perhaps *CQ* (is there still a *CQ*?) would cry foul. I submit that the federal government should, as an expedient to our reaching our goal in 3 short years, sell the management of amateur radio to the highest bidder in the free enterprise market, to be operated as a concession.

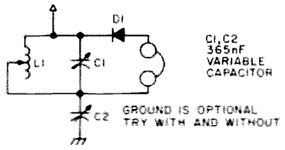
Cereal companies have an inherent edge here, since they have the box-top and $1.98 marketing technique down to a science. Providing an aspirant can demonstrate the ability to properly fill out the coupon, locate the proof of purchase seal on the package, and has the requisite $1.98 or equal value in food stamps, nobody should have any difficulty in becoming a genuine radio amateur, state of the art.

A test frequency has been set aside where this is essentially the licensing technique. If you care to listen, it's 27.185 MHz.

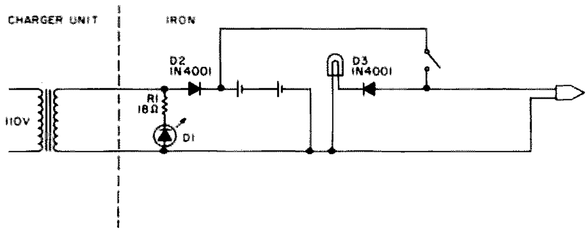
Robert G. Wheaton W5XW
San Antonio TX

Thank you, you've been most helpful. Now, does anyone else have any more gasoline to throw on this here fire?—Wayne

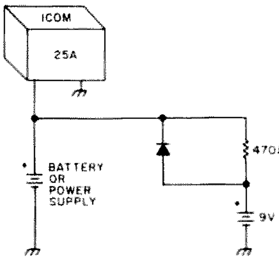
CIRCUITS



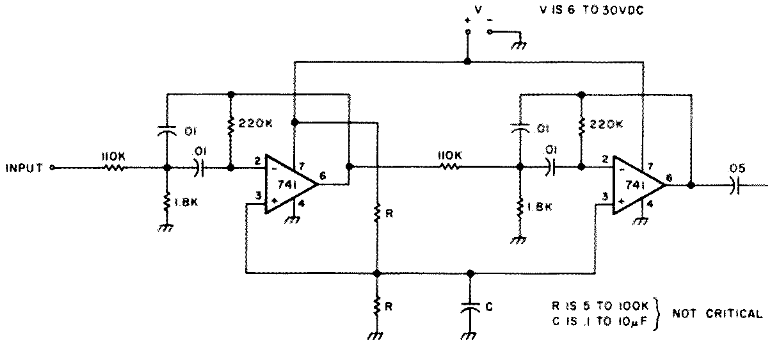
AM BROADCAST RECEIVER: Here is a neat project for a first-time builder. The gimmick is the coil L1. By using an alligator clip at the various taps on the coil, stations are shifted to the lower frequencies on the capacitor. This enables you to separate the stations more easily. D1 is a 1N34A—don't use a cheap diode. C1 and C2 are both 365-pF variable capacitors. A good earth ground is required (the finger-stop on a dial telephone is ideal).—Jim Burtoft N3BQH, Washington PA.



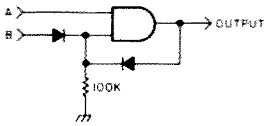
SOLDERING IRON MODIFICATION: To have a better rechargeable soldering iron, remove the diode from the charging unit and install it on the soldering iron. Because the nicads in the iron will now be isolated from the charging pins, it will be impossible to short out. By placing an LED with a current-limiting resistor into the iron, you will get a visual indication every time the battery is charging. Installing the circuit shown here will enable you to charge your battery from either ac or dc. By installing a power diode in the headlamp circuit, the lamp is protected against accidentally burning out when the battery is at full charge.—Richard J. Molby WB7NZG/DA1DB, APO NY.



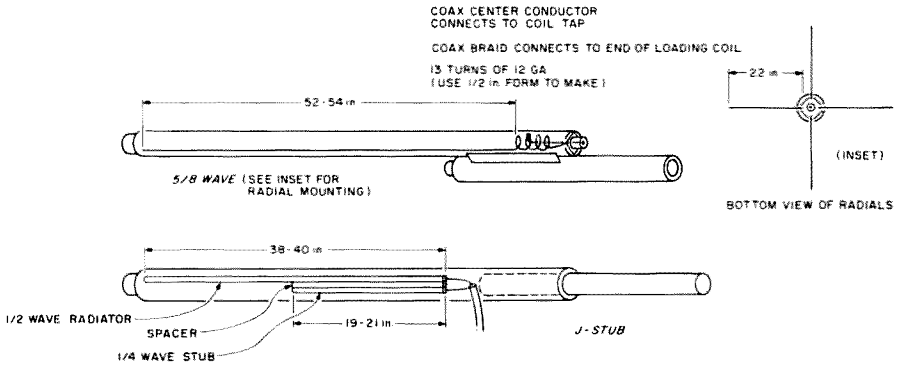
IC-25A BATTERY BACKUP: Here is a simple but effective battery backup for retaining memory when the rig is temporarily removed from the power supply. In tests, the battery retained the memory over eight hours.—Francis J. Piraino WA3KKM, Pocono Summit PA.



TWO-STAGE ACTIVE FILTER: This filter passes an 800-Hz signal. A single section has a bandwidth of about 150 Hz; the two-stage version's bandwidth is approximately 100 Hz. Gain is close to unity at the passband center. The circuit should be added in a low-drive-level section of the audio amplifier if a 12-volt power supply is used.—Penn Clower W1BG, Andover MA.



SIMPLE AND/OR LATCH: This circuit can be used to trip a repeater relay in a timer circuit. For example, if A is high and B is pulsed by a timer, the output will latch high until the input signal ceases. The high output can be used to disable the transmitter. This eliminates the necessity of having a timer which remains high until well after the desired count is reached. A brief pulse is all that is required. The resistor is needed to hold the B input low since the diodes isolate the input. An OR gate could be used in place of the diodes, but the diodes work well. The gate is a CMOS 4081 or a 4011 NOR gate coupled to an inverter at the output.—John Ackermann AG9V, Green Bay WI.



THE PVC PRINCIPLE VHF ANTENNA: Take one 6' and one 9' piece of 12-gauge copper wire and pull each piece until both are slightly longer. This serves to stiffen the copper. Wind the 6' piece 13 turns on a ½-inch form. Leave ½ inch unwound to make a connection. Remove the coil form and cut the "one piece" radiator as shown. Solder one end of a short length of 28-gauge copper wire to the center terminal of an SO-239 and the other to an alligator clip. Attach the clip to the coil about 2 turns from the radiator. Cut the 9' piece into four equal lengths (2¼') and attach them to the SO-239 as shown. Hang the antenna so that you can trim it for vswr adjustment. Vswr is adjusted by 1) coil tap position, 2) spacing of coil turns, 3) radiator length, and 4) length/angle of radials. After vswr is optimum, solder the coil tap in place. The trimmed antenna can be slid into PVC pipe and epoxied into place. To make the J-stub, take three pieces of RG-8 coax, two 19-21 inches and one 38-40 inches. Carefully remove the outer insulation and braid. Lay the three pieces on a flat table and tape them together temporarily. Solder the coax to the antenna, and connect it to the radiator and the braid to the stub. The radiator/stub assembly can be slid into a PVC pipe. Unsolder the coax, thread it through the hole, and solder it back. The end can be capped and coax putty applied.—Jack Sammarco KC2FS, Union NJ.

NEW PRODUCTS

16-DIGIT DTMF DECODER

Palomar Engineers has announced a new low-cost 16-digit decoder, model P-411. The decoder features high-input impedance so it does not load the line, crystal control for long-term stability and operation over a wide temperature range, dual band-pass filters ahead of the detector, and digital logic that makes it almost entirely free of false outputs. The P-411 operates from + 12 volts dc and has a 16-line output as well as BCD code and strobe on 5 lines.

For further information, contact *Palomar Engineers, 1924F W. Mission Road, Escondido CA 92025; (714)-747-3343.*

PORTABLE EARTH STATION

The first completely portable, battery-powered Earth station for receiving satellite transmitted television has been introduced by Gillaspie and Associates, manufacturers of state-of-the-art satellite equipment. The system can be tossed into a station wagon or recreational vehicle and used by campers to watch up to 105 channels of TV. The product also has more serious applications because of its ability to provide visual and audio information and data to remote, communications-poor areas.

The system can provide nine to ten hours of television before the batteries have to be recharged, so it could be used to communicate in civil defense emergencies or natural disasters and in areas susceptible to power outages. The system consists of an 8- or 10-foot metalized-fabric dish antenna that collapses like an umbrella, and a battery-operated satellite receiver complete with a five-inch screen. It can be hooked up to a battery-powered television set if a larger picture is desired.

The portable unit, like the larger home systems, collects microwave beams sent from satellites circling 23,000 miles above. It electronically amplifies less than one Watt of power more than 10,000 times to produce clear, undistorted picture and sound.

Additional information may be obtained through *Diane McNutt, Donald J. Sherman & Associates, 4300 Stevens Creek Boulevard, San Jose CA 95129; (408)-247-7300.* Reader Service number 489.

LOW-COST WIND POWER

Thermax has announced a new wind generator design for small power systems. The TC25WG helius rotor kit was developed as a low-cost battery charger for remote sites and applications, including power for camping, boats, radio operation, RVs, cottages, experimentation, and emergency power. The patented helius design offers several advantages: It responds to winds from any direction and is self-starting. The TC25WG rotor operates at low rpm and avoids overspeed problems common in propeller designs. Virtually no maintenance is required, and the Lexan® vanes resist sun, snow, sleet, and extreme temperatures. Assembly is easy with regular hand tools.

A free information package and further information are available from *Thermax Corporation, One Mill Street, Burlington VT 05401.* Reader Service number 481.

SUPER-RATT SOFTWARE

With the Super-Ratt radioteletype and CW program for the Apple II, you can have your own RTTY RBBS station on line quickly and easily, according to Universal Software Systems. Super-Ratt is the lowest-priced RTTY/CW program which also contains a full radio bulletin board system.

The program will operate in ASCII as well as Baudot at any speed from 40 to 300 baud. CW speeds range from 5 to 100 wpm, with an automatic speed adjust on receive.

The program may be run in either manual or RBBS modes. Extensive use of disk files permits storage of "canned" material for manual operation. In the RBBS mode, the system automatically saves nearly one hundred user messages to the disk. There are thirty-five different commands on the RBBS. They are all simple English words—and quite memorable.

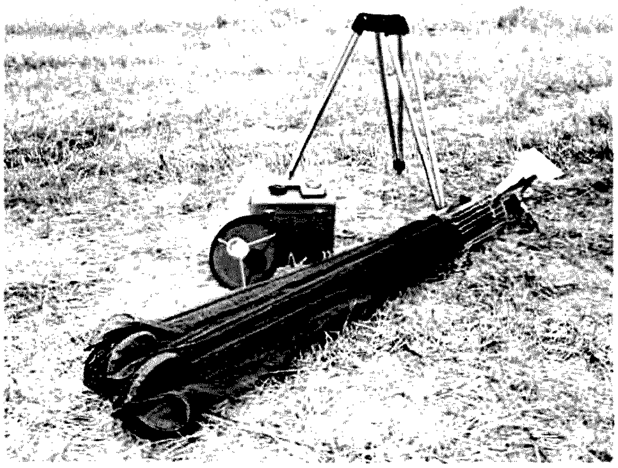
Almost any modern terminal unit or converter, such as IRL, Flesher, Kantronics, HAL, or others can be used with Super-Ratt as well as such devices as the "RADCOM" card by AF6W. The program is not protected against copying. The Basic portion may be listed and modified to suit your tastes. (The registered owner's call is installed in the machine code by the factory.)

A free one-year subscription to the user newsletter, *The Ratt's Nest,* is included in the purchase price of $59.95, which also covers shipping via UPS or first-class mail.

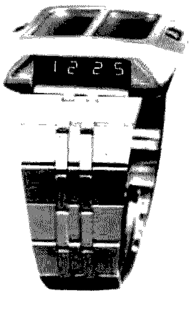
For a complete data sheet or other information, write or call *Universal Software Systems, Inc., 9 Shields Lane, Ridgefield CT 06877; (203)-438-3117.* Reader Service number 488.

The helius rotor kit by Thermax for low-cost wind power.

The portable Earth station—in operation.



The portable Earth station from Gillaspie and Associates—ready to put up.



The Synchronar 2100 solar watch.

SOLAR WATCH

Riehl Time Corporation has just announced a new technological breakthrough in wristwatches, the Synchronar 2100, powered by the sun and programmed to the year 2100 with no resetting required, even for daylight saving time or leap-year adjustments. Miniature silicon solar cells automatically gather and store energy from the sun, daylight, or even an ordinary lightbulb, and this energy is used to drive a complex integrated circuit. The solar cells also measure the ambient light and adjust the brightness of the readout so that it may be viewed under any lighting conditions ranging from full sunlight to total darkness. Synchronar's system totally eliminates the problem of battery replacements, and even if left in a drawer for months, it will continue to operate.

Synchronar 2100 has dual time zones and is available in either standard or international time modes or a combination of both. It is guaranteed accurate to within plus or minus four seconds per year. An exclusive self-calibration system enables the wearer to adjust the watch to run faster or slower, should environmental extremes require recalibration.

A discrete alarm system, or "polite" alert, is provided which, at a prescribed time, causes the display to flash on and off for a period of one minute. Synchronar 2100 features a patented, totally-sealed construction in which all electronic systems are encapsulated within a transparent Lexan module which can withstand shocks up to 25,000 G and water depths up to 750 feet.

Light enters the top surface of the transparent module and charges the solar cells, and the lighted display shines out through the edge above the band, providing a naturally-positioned side view. Control switches are magnetically operated from outside the watch, meaning that the seal of the module is never broken.

For further information, contact *Riehl Time Corporation, 53 South Jefferson Road, Whippany NJ 07981*. Reader Service number 485.

RADIO RACK

The Guild Radio Rack comes in finished solid ash. No assembly is required. Guild's rack comfortably holds Kenwood's TS830S/VF0230/SP230 or TS820 series, or any similar rigs. Exact measurements are (overall) 16-7/8" W times 14-3/4" H times 14-1/2" D; (top compartments) 7-1/2" W times 6" H, and (bottom compartment) 15-5/8" W times 7" H. It is also fully vented.

For more information, contact *Guild Radio Rack, 225 West Grand St., Elizabeth NJ 07202; (201)-351-3002*. Reader Service number 487.

TRIBAND BEAM

TET Antenna Systems has announced that their top-of-the-line HB35T triband beam is now available. This is a 5-element dual-drive antenna for 20, 15, and 10 meters. With the dual drive concept, both the radiator and the reflector are driven with a phase difference that provides extra gain and improved front-to-back ratio.

The beam has only one pair of traps per element for simplicity and reliability. The trap capacitors are coaxial rods mounted inside the elements to give low losses and weatherproof operation.

The HB35T has a 25' boom, weighs 50 lbs., and provides excellent gain for DX work.

For further information, contact *TET Antenna Systems, 1924E W Mission Road, Escondido CA 92025*. Reader Service number 480.

HAMTRONICS FM REPEATER

Hamtronics, Inc., has announced the availability of the REP-100 line of complete repeater packages, including all the hardware and controls.

The REP-100 is constructed on a 7-inch rack panel, with an uncluttered control arrangement. Electrical features include excellent sensitivity (0.15 uV at VHF and 0.2 uV on UHF), both 8-pole crystal filter and ceramic filter for ± 12 kHz at − 100 dB, afc and hysteresis squelch to lock onto drifting or fading signals, a clean, easy-to-tune transmitter, and up to 20 Watts output. A proportional-controlled crystal oven option provides 2 ppm frequency stability down as low as − 30° C (− 22° F), if needed.

The REP-100 repeater is available for the 6m, 2m, 220-MHz, and 440-MHz bands and adjacent frequencies. It is available also in configurations for remote linking and crossbanding, including 10 meters. The 2m and 220-MHz models employ a 3-section helical resonator in the receiver front end. The UHF version uses 6 tuned lines in the receiver. (That is important if you share a site with other transmitters.)

A complete catalog on the REP-100 repeater, and other information, is available from *Hamtronics, Inc., 65-F Moul Rd., Hilton NY 14468-9535; (716)-392-9430*. (For overseas mailing, please enclose $1.00 or 4 IRCs.) Reader Service number 491.

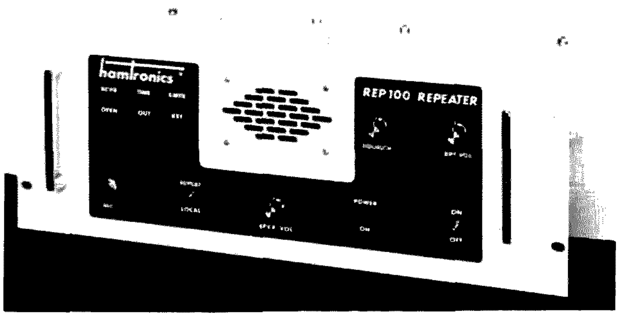
The Guild Radio Rack.

SATELLITE TV ANTENNA KIT

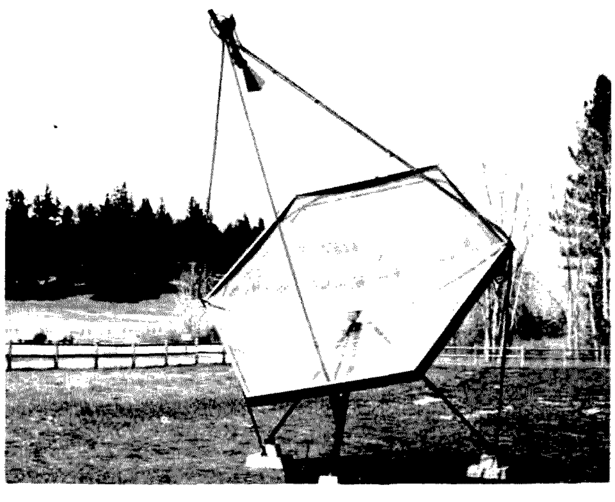
Ghost Fighters, television antenna specialists, has announced the Space Cowboy P-600 series of parabolic antenna kits.

The Space Cowboy P-610 is a 10-foot hexagonal parabolic microwave antenna specifically designed to receive signals from all the domestic satellites, with over 60 channels of video and audio programming to choose from. It tracks the satellite orbit belt on a polar mount and changes from satellite to satellite in seconds. This kit is for the home-video enthusiast who wants to save money and have the satisfaction of building.

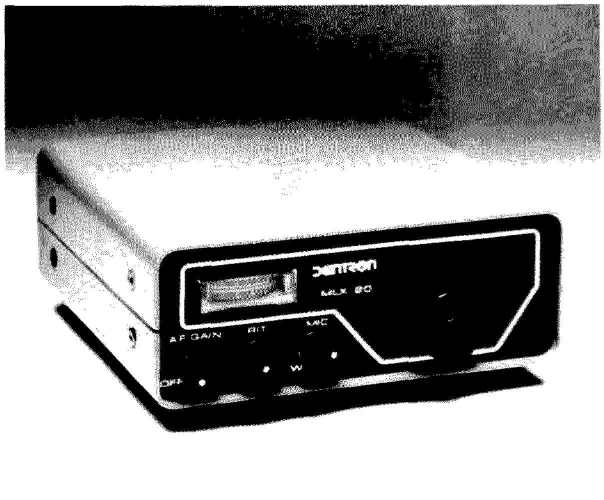
The P-610 model, compared with most 10-foot fiberglass dishes, has a surface-intercept area 10% larger and a longer-than-average focal length. Surface accuracy is proofed-on-site and fully tunable over the entire surface on a point-by-point basis (patent pending) for maximum gain and good picture quality. The surface is heavy-duty galvanized steel screen. The P-610 is a true parabolic reflector with at-



The Hamtronics REP-100 repeater.



The Space Cowboy by Ghost Fighters.



DenTron's MLX Mini transceiver.

tached feedhorn assembly and adjustable polar mount for easy selection of satellites.

The kit comes complete with all materials pre-cut and ready for assembly. Some portions of the assembly will require two persons. Assembly and installation of the antenna can be accomplished by the average homeowner in a weekend or two. The polar mount is set on three concrete footings requiring 4 to 6 bags of pre-mix concrete.

Other models in the P-600 series include the P-613 and P-616 (13- and 16-foot antennas respectively).

For further information, contact *Ghost Fighters, TV Antenna Specialists, Route 2, Box 136-B, Stevensville MT 59870; (406)-642-3405*. Reader Service number 479.

NEW MICRO SIDEBAND TRANSCEIVER

DenTron Radio Company has announced production of its new mini-sized, monoband transceiver. Titled the MLX Mini, it operates at 25-W PEP and 20-W CW with an LED frequency readout of ± 100 Hz accuracy. Available in models from 160-6 meters, the MLX Mini has selectivity of 2.1 Hz with sensitivity better than .35 uV for 10-dB signal-to-noise ratio. Receiver design is the single-conversion superheterodyne type with total power requirements of 12-14 V dc.

For more information contact *Tim Neill, Technical Sales Representative, DenTron Radio Company, Inc., 1605 Commerce Drive, Stow OH 44224; (216)-688-4973*. Reader Service number 482.

GLOBAL'S DIGITAL PULSER KIT

The DPK-1, a new digital pulser kit designed for use as a pulse injector in stimulus/response testing of digital circuitry, has been introduced by Global Specialties Corporation.

This pulse generator is a portable test instrument featuring multi-logic-family compatibility; it operates on both TTL and CMOS circuits. Its pulse width is 1.5 seconds ± 30% for TTL and 5-V CMOS and 3.0 seconds ± 30% for 15-V CMOS.

One touch of the pulse button and the DPK-1 attempts to inject a positive pulse, then a negative pulse. One of these pulses is ignored, depending on the logic state the DPK-1 output is biased at (determined from node under test). Keep the pulse button depressed and after one second the DPK-1 delivers a continuous pulse train of positive and negative pulses at a rate of 150 pulses per second. In the same manner as the single-shot event, one of these pulses will be ignored, leaving a positive- or negative-going pulse train at a 75-pulse-per-second rate.

An LED indicator flashes once to confirm single-pulse output and remains on for continuous pulse train confirmation.

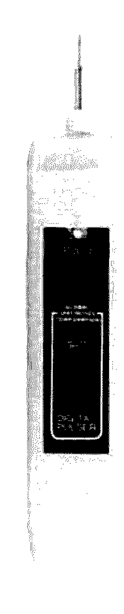
Pulse voltage level is determined by the current requirements of the node under test. The DPK-1 output pulses are capable of sinking or sourcing up to 100 mA, which is sufficient drive to permit forcing most nodes to an opposite state without desoldering.

This digital-pulse generator offers short-circuit protection. High impedance output (minimum, 20-megohm) when not pulsing allows the DPK-1 to pulse into a short circuit continuously without damage.

The DPK-1 is circuit-powered at 5-18 V dc from Vcc of the circuit under test. A power cable, wired directly into the unit, terminates in two color-coded vinyl-jacketed alligator clips.

The DPK-1 digital pulser comes as a complete kit, including all parts, solder, wire, PCB, etc., and a comprehensive construction and operating manual. Kit construction and testing can usually be completed in one to three hours. Its dimensions are 5.8" × 1.0" × 0.7", and it weighs 3 oz.

For further information, contact *Global Specialties Corporation, 70 Fulton Terrace, PO Box 1942, New Haven CT 06509; (203)-624-3103*.



Global's digital pulser kit

AIDS FOR THE BLIND AMATEUR

Although many textbooks have been translated into braille and onto recorded media, blind hams, technicians, and scientists are faced with the continual frustration of obtaining current and supplemental materials.

The Rehabilitation Engineering Center publishes a newsletter quarterly in braille, large print, and recorded form which will serve as a guide to the current technology as applied to the needs of the blind and persons with impaired vision. The newsletter, called *Technical File*, facilitates the pursuit of electronics interests among technically-oriented, visually-impaired persons by serving as a reference source, a teaching tool, and a hands-on guide for construction projects through lists of materials already transcribed, catalog abstracts, data on integrated circuits, manufacturers' applications notes, and construction details, to list just a few of the contents.

General interest, do-it-yourself descriptions of such processes as soldering, project layout on circuit boards, and the use of power tools focus directly on techniques used by the blind. The articles in *Technical File* are submitted by readers, training-facility personnel, and other interested professionals and non-professionals.

In the Winter, 1982, issue, for example, "Soldering, Part IV," "Singing Chips," "A Tactile Read-Out for Digital Instruments," "Earphones for the Blind Traveler," and "Vocational Aids Catalog" were among the features. Bill Gerrey's "Editor's Corner" and "Editor's Crystal Ball" are always popular.

For your subscription to the Braille Edition ($12 per year), the Large Print Edition ($12 per year), or the Talking Book Edition ($6 per year for half-track cassette, 15/16 IPS) contact *Bill Gerrey, Editor, Smith Kettlewell Eye Research Foundation, 2232 Webster Street, San Francisco CA 94115*. Reader Service number 476.

PROHAM'S FASTRAK ELECTRONIC KITS

Proham Electronics, Inc., has just introduced a new line of electronic kits dubbed the Fastrak™ series, wherein each kit is a functional building block that can be assembled in less than one evening. Fastrak modules are for the novice and experienced home-brewer alike, providing not only versatility but complete documentation as well. Each module is built on a commercial-grade printed circuit board that conforms to the HAM (Hardware Application Module) Standard described in the May, 1982, issue of *QEX* magazine, and is uniform in size. Exact board dimensions are governed by the amount of space required to accomplish the intended electronic function, but connector arrangements, bus wiring, and PC-board form factor are uniform and constant for simplicity of assembly and interconnection between units.

Fastrak modules feature a top-down system design, making it easy to configure and assemble complete receivers, transmitters, controllers, and instruments from standard "family" members. Ten Fastrak modules are available, with another ten coming within six months. Functions performed range from basic voltage-regulator and audio-amplifier modules to a 2-chip DTMF decoder and a 1-chip TV.

Fastrak kits come with complete documentation and use readily available components. For more information, write *Proham Electronics, Inc., 34620 Lakeland Boulevard, Eastlake OH 44094*.

ICOM IC-45A SYNTHESIZED UHF MOBILE

Icom has announced availability of the IC-45A, providing FM mobile coverage of 440-450 MHz. Major features are its small size (2" H × 5½" W × 7" D), easy-to-read LEDs, 5 memories, priority channel, band and memory scan with automatic resume, memory backup provisions, 1-MHz up-button for quick QSY, and variable duplex offsets. The touchtone™ microphone is included.

For more information, contact *Icom America, Inc., 2112 116th Ave. NE, Bellevue WA 98004; (206)-454-8155*.

The Icom IC-45A synthesized UHF mobile

MOBILE ANTENNAS

Valor Enterprises, Inc., introduced a new series of mobile high-frequency antennas at the Chicago CES Show last June. These HF mobile antennas for the professional and amateur operator are approximately 8 feet in length, and are of a heavy-duty, slim line construction designed for HF amateur bands on 75, 40, 20, 15, and 10 meters. Heavy-gauge copper wire wound on ½" fiberglass with nickel-chrome brass fittings, and 17-7 taper ground stainless-steel

whips ensure dependable mobile operation. The 4' stainless-steel whip is field-tuned for lowest vswr and double-locked with stainless-steel set screws. The antennas feature 3/8-24 ferrules to fit standard mobile mounts and are power-rated at 500 Watts PEP for top mobile performance.

For further details, contact *Valor Enterprises, Inc., 185 W. Hamilton St., West Milton OH 45383.* Reader Service number 484.

RETICON ACTIVE FILTER

Applied Invention is the source for the recently introduced Reticon R-5620 programmable active filter—a complex MOS integrated circuit. The R-5620 uses switched-capacitor technology to synthesize a two-pole pair active filter that requires no external components and operates over the range of 0.05 to 25 kHz.

The five basic filter types: low-pass, high-pass, bandpass, band reject, and all-pass can all be implemented by the R-5620, and a programmable sine-wave oscillator is also possible.

Switched-capacitor filters (SCFs) are analog filters in which fixed resistors are replaced by time-division-variable switched capacitors, resulting in very stable filters that can be tuned with a variable clock source.

The simple programmability of this new SCF makes it attractive for computer-controlled synthesizers and other analog/digital systems applications.

For additional information, contact *Applied Invention, RFD #2, Route 21, Hillsdale NY 12520.* Reader Service number 483.

YAESU'S ACTIVE ANTENNA

Yaesu Electronics Corporation recently announced the introduction of the FRA-7700 active antenna for the FRG-7700 deluxe HF receiver.

The FRA-7700 utilizes a four-foot (1.2-meter) whip in conjunction with a low-distortion MOSFET preamplifier, providing shortwave reception for receiver owners unable to erect an outdoor antenna. The FRA-7700 includes front-panel gain control, tuned-circuit peaking, and a preamplifier on/off switch for maximum versatility.

For details on the FRA-7700, contact *Yaesu Electronics Corp., PO Box 49, Paramount CA 90723.* Reader Service number 486.

RT-1100 MULTIMODE TERMINAL

DGM Electronics has just introduced the RT-1100 receive terminal for Baudot, ASCII, and Morse. The RT-1100 converts the audio from your receiver, decodes it, and displays the words on a video monitor or TV set (using rf modulator). The RT-1100 incorporates an active filter demodulator with scope-tuning outputs. It will copy 170-, 425-, and 850-Hz-shift RTTY signals at speeds of 60, 66, 75, and 100 wpm on Baudot and 110 baud on ASCII. The unit will copy 6-60 wpm Morse signals using automatic or manual speed tracking. The RT-1100 has a parallel ASCII printer output for hard copy. The video output provides 16 lines of 32 characters per line with 2 pages. The second page is stored in memory and can be recalled by using the page 1-2 switch on the front panel. The unit has a built-in 110-V-ac power supply and is housed in an attractive 3" × 10" × 10" case with brushed, anodized front and rear panels. The cover is a gray wrinkle finish. The unit comes with a one-year warranty on parts and labor.

For more information, contact *DGM Electronics, Inc., 787 Briar Lane, Beloit WI 53511; (608)-362-0410.* Reader Service number 477.

MOBILE ANTENNA CONVERTER

JL Industries has just announced their new X-Panda-Five mobile antenna adapter, which enables the owner of a Hustler, Hy-Gain, or similar mobile antenna to convert his antenna to a five-bander by adding resonators.

The X-Panda-Five consists of a precision-machined aluminum hub fitted with five rustproof 3/8" by 24" studs made from high-tensile-strength carbon steel. The hub is attached to the antenna mast, and each of the five resonators screws onto the hub. One resonator is mounted vertically and four are mounted horizontally.

When the adapter is installed on your antenna, you can use either regular or super-size resonators and change bands without leaving the driver's seat. This assumes, of course, that you pre-tune each resonator to your favorite operating frequency in that band. No antenna tuner is required.

The X-Panda-Five also makes a good antenna for apartment houses and condominiums when fitted with the appropriate resonators and ground planes. It can be used to make a multiband antenna system for vans, campers, motor homes, and travel trailers.

For more information, contact *JL Industries, PO Box 030413, Fort Lauderdale FL 33303.* Reader Service number 490.

DGM Electronics' RT-1100 receive terminal.

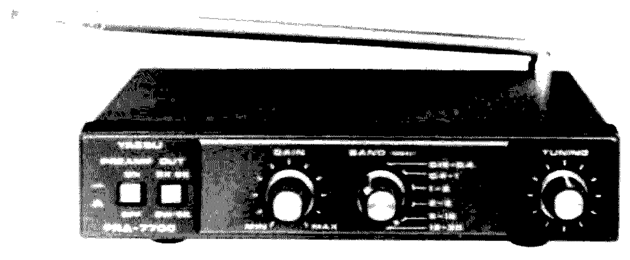
ANTENNA COUPLER

Wayne Research & Development has announced the availability of a new antenna coupler that replaces the center insulator of a balanced rf antenna system. The Wayne B-T-L antenna coupler contains an air balun, a tapped inductor, and a variable capacitor. The coupler is housed in an ABS plastic box with a removable lid for inspection and servicing. The strain insulator is made of Delrin® plastic.

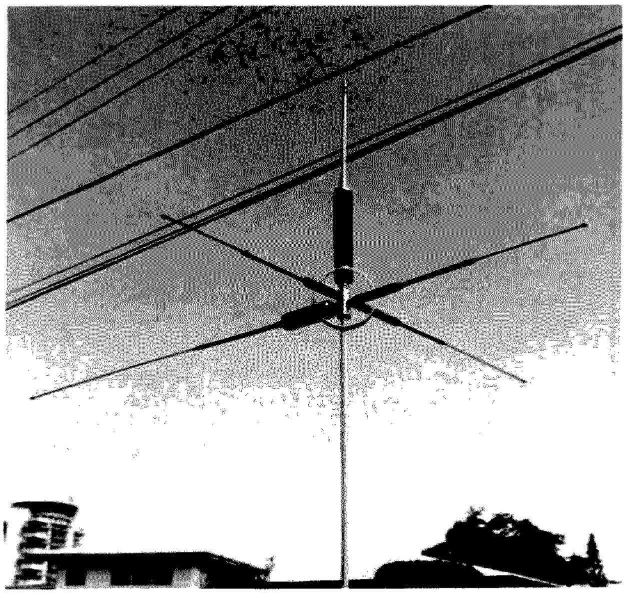
With the aid of graphs in the instruction booklet (supplied) and an swr meter, the user can design a matching network to match the low impedance of his wire beam or the high impedance of his loop antennas. Using the network as a T or an L, the Wayne B-T-L antenna coupler will match impedances over a frequency range from 1.8 to 30 MHz.

The insertion loss is not more than −0.006 dB from 1.8 to 25 MHz, and minimal from 25 to 30 MHz. The introductory price is $49.95. For further information, contact *Wayne L. Jamison W5FJS, Wayne Research & Development, PO Box 75144, Houston TX 77234.* Reader Service number 478.

The Wayne B-T-L antenna coupler.



Yaesu's FRA-7700 active antenna.



The X-Panda-Five mobile antenna adapter by J. L. Industries.

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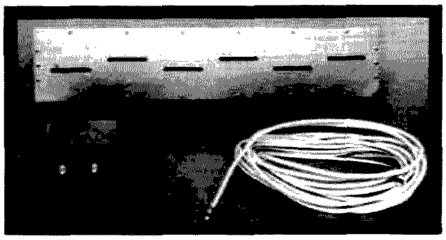

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MODEL K-7000-AC 10 Hz to 550 MHz counter 50 Ohm & 1 Megohm inputs via BNC type connectors on rear panel. This model is available in optional kit form.

#K-7000-AC	counter assembled 115VAC 12VDC	$150.00
#K-7000-ACK	counter kit form	120.00
#NiCad 70	internal NiCad battery pack	25.00

MODEL 7010-S 10 Hz to 600 MHz counter 50 Ohm & 1 megohm inputs via BNC type connectors on rear panel. Precision TCXO or optional 0.1 PPM ovenized (OCXO) time base. Both have 10 turn calibration adjustment accessible from rear panel. Excellent UHF sensitivity with new amplifier circuitry. Optional extended frequency range to 1 GHz.

7010-S	600 MHz counter 115VAC 12VDC	$199.00
#ER-1000	1 GHz extended frequency range	95.00
#OCXO-70	Ovenized .01 PPM time base Osc	65.00
#NiCad 70	Internal NiCad Battery Pack	25.00

MODEL 8010-S Deluxe 10 Hz to 600 MHz counter. External 10 MHz clock input output on rear panel display. HOLD function display. TEST function. Optional 1 GHz extended range. Excellent sensitivity. Optional ultra precision ovenized oscillator with ±0.05 PPM stability 10-45°C

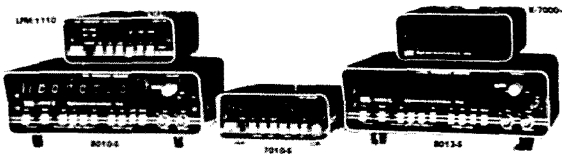
#8010-S	600 MHz counter 115VAC 12VDC	$295.00
#ER 1000	1 GHz extended frequency range	95.00
#OCXO-80	0.05 PPM oven time base	105.00
#NiCAD 80	internal NiCad battery pack	60.00

MODEL 8013-S 10 Hz to 1.3 GHz frequency counter. Has all features of model 8010-S plus standard range to 1.3 GHz. Typical sensitivity of 1.3 GHz 50 mv (-13 DBM)

#8013-S	1.3 GHz counter 115VAC 12VDC	$495.00
#OCXO-80	0.05 PPM oven time base	105.00
#NiCad 80	internal NiCad battery pack	60.00

MODEL LFM 1110 Low frequency multiplier. A frequency counter accessory enabling low frequencies to be counted faster and more accurately. Has low pass filter for off-the-air tone-squelch measurements. BNC input output.

#LFM 1110	Low frequency multiplier 115VAC 12VDC	$125.00
#NiCad 1110	internal NiCad battery pack	25.00
#BNC-PC	3 ft 50 Ohm BNC patch cable	9.95



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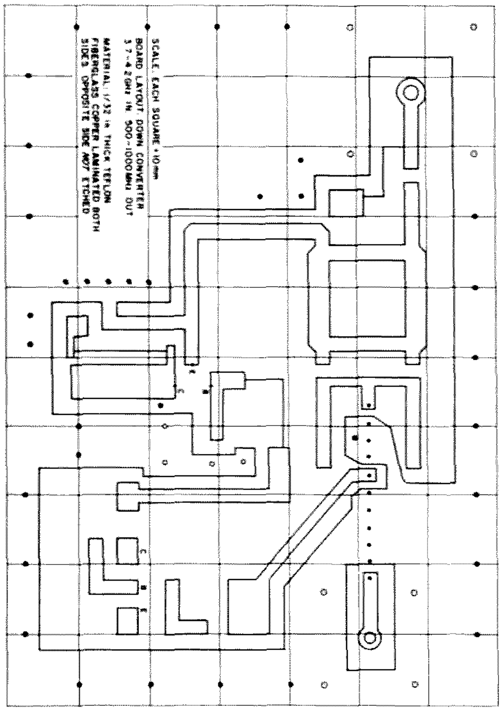


G. W. Legel's (N6TO) article "Dissertation Upon Roast Pig" (October) offers an interesting and useful suggestion for transformer salvage, but ignores an extremely important personal caveat.

Old transformers were frequently filled with polychlorinated biphenyls (PCBs). This is a dangerous, toxic material that should be dealt with by trained professionals. Old, oil-cooled transformers must be presumed contaminated. Unless they bear a green certification sticker, they should not be handled by amateurs under any circumstances.

Tom Archer KC8MR
Huron OH

The $100 TVRO receiver is a real winner. I'm going to build one, except for one small detail. The August issue of *73* (on page 64) has the layout of the downconverter used in Rex's "Cheap Trick." The only problem is that in Fig. 4 the scale is 10mm per division. The printed version is 128mm long when it should be 100mm. I'm sure that was done for clarity, but it is hard to interpolate 128mm to 100mm. I'm also sure that you know the dimensions at the frequency are critical.

What I'm asking is if you have an actual-size drawing from Steve Gibson, could you print it in the next issue at 1:1? Please??

David Lawson WA1YMC/5
Dallas TX

Here you go.—*Ed.*

Fig. 1 in "The Vertical Deuce," on page 81 of the September issue, was drawn incorrectly. As drawn, closing the relay would put a short across the center conductor and braid of the feedline. Instead, the braid should be connected directly to ground and the center conductor should be hooked up to the coil at the opposite end from the antenna.

Avery Jenkins WB8JLG
***73* Staff**

HAM HELP

I need the manual and/or schematic for a Knight T150 transmitter. I am willing to pay a reasonable amount for any information.

J. W. Roberson W5RDI
745 Willow St.
Hurst TX 76053

Anyone out there have a schematic for an Ameco six-meter type CN VHF converter? Expenses will be reimbursed.

H. S. Robb AF0W
Box 17
Bird Island MN 55310

I would appreciate information on using the Interact computer in amateur radio applications.

George W. Moran W2DGZ
950 Erlen Drive
York PA 17402

I need a schematic for a Majestic Fairfax model 200 superhet broadcast receiver. I will pay copy/mail costs.

Dan Sindorf KS0C
11937 McCoy Drive
Omaha NE 68123

REVIEW

THE HF 10/160 SOLID-STATE PLL TRANSCEIVER

The voice at the other end of the telephone line belonged to Bruce Stwertnik, president of National Communications Group, Inc., importers of that nice little NCG 15-meter monoband rig which was reported on in the July, 1981, *73*. Now, it isn't unusual for Bruce to call and chat, but I sensed that he had something special up his sleeve this time. After the usual chitchat, he dropped the other shoe: "Jim, I've just got a new rig in from Japan, how'd you like to put it through its paces?"

At the hint of something new and possibly different, my mind began racing with questions such as what kind of rig? For which bands? How much power? What does it look like? How does it play? What features? You know the kind of things I mean... but I barely managed to get a few of them across to Bruce as I quickly stammered a "Sure, I'd be delighted!"

Bruce hastened to explain that this rig would be a scoop for *73* since there are only two in the States at the moment, but a lot more on the way. I was to get the first one to test and Bruce was to keep the other for himself. As a matter of fact, the English-language manuals weren't quite ready yet, he said, so I could expect only a spec sheet and a brief translation of some of the features, operating hints, and comparisons with similar rigs currently on the market.

The NCG HF 10/160 transceiver is much as one would expect. It is definitely a new-generation transceiver, with solid-state circuitry and PLL frequency synthesis. And apparently, if one can judge from the pictures in *CQ-Ham Radio*, the Japanese amateur radio magazine, it has been in use in Japan for some time.

Physical Description

The transceiver is manufactured by Matsushita Electronic Industries Company Ltd., a parent company of Panasonic, among others. It measures approximately 13 inches wide by 5-1/2 inches high by 16 inches deep (if you count the massive rear-panel heat sink) and weighs just shy of 21 pounds... but wait a minute: that includes both ac and dc supplies—built in! No need for an external supply, whether you are mobile or fixed. The usual tilt bail on the bottom to raise the rig to a comfortable angle for viewing the front panel is provided, and there is the side carrying handle intended to make the rig conveniently portable. The case is dull black and has a vaguely military, i.e., functional, look. Perhaps the first thing you notice is the centrally-located spinner dial on the front panel, just below the large digital readout frequency display whose green alphanumerics are nearly one-half inch high and are easy to read. There are prefix letters ahead of the numbers when the rig is operated in its various modes: "C" for CW, "U" for upper sideband, and "L" for lower sideband.

The VOX sensitivity, VOX delay, and anti-VOX controls are on the left-hand side of the rig, and the VOX sensitivity control knob has a concentric switch for the 100-kHz frequency marker provided in addition to the synthesized readout, because this permits the on-board phase-locked-loop circuitry to be zeroed against WWV, for example.

The new bands are provided for as well, and the rig covers all amateur frequencies with generous overlap on the ends for MARS or other use. The S-meter dial is in the upper left-hand corner, and indicates relative power output or ALC (your choice) in the transmit mode and S-meter readings in the receive mode. As a matter of fact, I think you would be particularly pleased with the S-meter, as it doesn't seem to be particularly scotch or particularly generous. Somehow, I have the feeling that it is about right—and consistent—from band to band.

The power on-off switch is a toggle in the upper left-hand corner; below the meter is a row of switches that control receiver functions such as noise blanker, meter scale, fast-slow agc, and tuning rate. The tuning device is an optical chopper which permits simple dial lock to a desired frequency simply by disengaging the manual dial. There is a tuning-rate switch that permits you to tune each band in 25-Hz, 100-Hz, or 1-kHz increments. Right next to that manual selector is an auto-tuning switch that functions in the up or down modes, and changes frequency at the rate selected by the adjacent rate switch. I never thought I would need—or want—such a device, but it's handy and I use it a lot.

Below the switches just mentioned are the microphone connector (standard Japanese 4-pin) and the phone jack (standard 1/4-inch diameter) right next to it. Then comes the key jack, which uses the smaller-diameter plug of the size used to plug in speakers and the like (I believe it is .168" diameter). Fortunately, another rig I tested recently had this size key jack, so I was ready, but on the *front* panel? Why there of all places? The answer is simple—convenience; I realized that as I recalled the many times I have fumbled around the back of a rig in the dark trying to find the key jack.

The HF 10/160 has a built-in speaker placed on the bottom plate of the rig, and a jack for an external speaker should you wish to use one. I found the audio quality to be quite good, even with the small enclosed speaker... and that certainly is the way to go for portable/mobile... unless or until you wear headphones, of course. An external speaker is normally used in my shack, however, so I used that for the evaluation.

Next to the key jack is the mode-selector switch—permitting wide or narrow CW and upper or lower sideband... you have to choose which. On the dial escutcheon you will find two small push-buttons that activate the dial lock (left button) and the TX/RX REV switch. On the upper right-hand side of the panel you will find the Delta F switch and the RX offset switch (RIT).

The Delta F control corresponds to the receiver incremental tuning control (RIT) on the other rigs. By pushing the switch, a red LED comes on to show that the circuit is activated. Now, by varying the Delta F knob, you can adjust the receive frequency higher or lower than the dial-set frequency by about 1 kHz.

The TX/RX REV control permits further adjustment of the transmit or receive frequencies separately. When the switch is depressed, a red LED is illuminated to show that the circuit is active. Here's how it works. Suppose you want to leave your transmit frequency where it is but wish to change the receive frequency. Push in the TX/RX REV switch to lock the transmitter frequency on the existing dial setting. Now the receive frequency can be adjusted by the main tuning dial. This gives the effect of a dual vfo, and permits you to set the transmitter "up five," for example, when working DX on a split frequency, and then use the receiver and main dial to tune the DX station. If you wish to listen to *your* frequency momentarily, turn the TX/RX REV switch off, and presto, you're back on the transmit frequency with the receiver.

The memory-selection push-buttons are next, and require a separate discussion—so we'll come back to them later. You should know, however, that you can store up to four different frequencies and scan between any part of them at a variable rate, using "autowatch."

If you really want to get fancy about all this, you can use all these features in concert: TX/RX REV, Delta F, and memory select. I am sure that an accomplished dial twister and button pusher could really play a symphony on this rig after a few evenings of practice. Versatility is the name of the game with the HF 10/160 from NCG, and it's unlikely you will run out of permutations and combinations to try.

The main control knobs of the transceiver lie below the switches, and include in the top row: transmit frequency variation (Delta F), i-f tuning (± 1 kHz) and the audio/rf gain controls on concentric shafts for the receiver; and in the bottom row: the mike gain/CW carrier-control knob, the audio-compressor/speech-processor control, and finally the bandswitch covering 1.8-29.7 MHz.

I found that all controls fall more or less conveniently to hand, and that if you have used any of the modern solid-state rigs from Japan, you will find everything about where you expect it. I was impressed with the nice manual tuning feel and the utter simplicity of using the rig.

Electrical Description

The NCG HF 10/160 contains 30 integrated circuits, 6 FETs, and 124 diodes/transistors. Power consumption is nominally 50 Watts on receiving in the ac mode, and 0.6 Amperes current drain in the dc mode. Transmitting consumes 550 Watts in the ac mode, and 20 Amperes current drain in the dc mode. Nominal dc voltage requirements are 13.8 volts (negative ground) at 20 Amps—enough to require that you have a battery charger, if portable, or a good alternator system if mobile and operating at the full-power capability. Ac requirements are the usual 120 volts, 50 cycles.

Band Coverage

The HF 10/160 covers 1.8-2.0 MHz in the 160-meter band, 3.5-4.0 MHz in the 80-meter band, 7.0-7.3 MHz in the 40-meter band, 10.0-10.5 MHz in the 30-meter band (providing some general reception, too), 14.0-14.35 MHz in the 20-meter band, 18.068-18.168 MHz in the 17-meter band, 21-21.45 MHz in the 15-meter band, 24.89-24.99 MHz in the 12-meter band, and 29.0-29.7 MHz in the 10-meter band.

Stability is given as less than ± 200 Hz within one hour and less than ± 20 Hz after one hour. A comment about the extraordinary frequency stability was received from a ham on 40 meters who had been listening to me for a half an hour. He mentioned that my frequency as measured on his frequency meter had not changed one cycle during the entire time he had been monitoring! This means that both voltage and temperature stability is excellent. The comment, by the way, was unsolicited.

Transmitter Description

The final-stage input is 200 Watts (160-12 meters) and 100 Watts on 10 meters. Balanced-type modulation is used, and carrier suppression is more than 40 dB. Sideband suppression is more than 50 dB, and spurious radiation is at a level below −40 dB. Microphone impedance is about anything you want, and a range of 600 to 50k Ohms is acceptable. The output connector for rf is the usual 50-Ohm UHF type SO-238.

NCG's HF 10/160 transceiver.

SOME FEATURES COMPARED

Feature	NCG 10/160	TS-830	FT-101
Tuning	PLL-synthesized	Vfo (capacitor)	Vfo (capacitor)
Power Supply	Ac/dc built in	Ac	Ac (dc optional)
Weight	21 pounds	30 pounds	32 pounds
Dimensions (H × W × D)	5.2 × 2.68 × 12.44	5.24 × 13.11 × 13.11	6.18 × 13.58 × 12.83
Frequency memory	Yes	No	No
Autoscan	Yes	No	No
Dual vfo	Yes	No	No
Tuning rate	3-step	N/A	N/A
Passband tuning	No	Yes	Yes
I-f tune	Yes	Yes	No
Notch filter	No	Yes	Yes
CW/af	Yes	No	Yes
Tone Control	No	Yes	No
Drift-free tune	Yes	No	No
All solid state	Yes	No	No

Receiver Description

The receiver is a single-conversion superheterodyne of the type well known for its good sensitivity and lack of images, yielding a factory-measured sensitivity figure of less than − 12 dB (.25 V) at 10-dB S/N ratio. The i-f frequency is 9.0007 MHz on CW and 9.000 MHz on phone. Selectivity on SSB or wide CW is 2.2 kHz at − 6 dB, less than 3.0 kHz at − 20 dB, and less than 6 kHz at − 60 dB down, for a shape factor of about 2.7. On narrow CW, the figures are 400 Hz at − 6 dB, 1 kHz at − 20 dB, and 1.6 kHz at − 60 dB, respectively. This gives a shape factor of about 4:1 for narrow CW. The narrow CW option could not be observed at the time of testing because the sharp filter had not yet been received.

Spurious images are down more than 60 dB, i-f rejection is likewise more than 60 dB, and other spurious response is down more than 70 dB.

With the built-in speaker (nominal 8-Ohm impedance), the audio output power is 0.5 Watts (10% THD) and with an external speaker, the audio output power is 1 Watt (10% THD).

Using the Rig

This report is necessarily a preliminary and admittedly sketchy evaluation because the manual I have is in Japanese. The English versions should be available (along with the rigs) by the time you read this. In spite of, or perhaps because of, the lack of an English-language manual, I found that I paid more careful attention to the drawings and photos than usual. These are abundantly clear, and it would be almost impossible to set up the rig incorrectly if you have had any experience at all in putting a "transceiver-from-the-box" on the air.

Carefully unpacking the rig from the usual sanitary plastic bags and foam-sheltered security of the container, I found a separate bag containing the microphone and still another small box with the ac and dc power cords inside. Selecting the ac cord, I plugged it into the polarized multi-pin socket on the back. My ground wire was put on the terminal, underneath the usual washer and wing nut. The microphone plugged into the usual 4-pin front-panel connector.

One obtains a first impression of any rig as it comes from its cocoon, and this one was no exception. Its general appearance, weight, and feel lend the impression that it is functional and business-like, with its matte black finish and vaguely military look.

Being a CW man at heart, I wanted to try that mode first, so I plugged my electronic keyer into the rig, switched the operate switch to VOX, and set the sensitivity control and delay control for comfortable semi-automatic break-in. Keying the rig produced a fine sidetone—pleasant to the ear—and my power-output meter showed a power output of approximately 70 Watts on 40 meters. A quick twist of the Mic Gain/CW CAR control brought the output to 100 Watts. The stations I worked on 80, 40, 20, and 5 meters all reported fine keying and good solid signals with a nice CW note.

The only small objection I had was from an operator who claimed that on the initial make (when the relay came on) there was a slight frequency warble which disappeared once the relay held in. (This will be corrected in subsequent production rigs.) However, if you choose to set the VOX delay to a long duration, there will be only one little warble at the beginning of the first character. This would also be true, of course, in the manual mode, and thereafter you should hear no complaints. Not having heard this myself, I can only report what that one operator told me. Significantly, perhaps, no one else mentioned it.

I was somewhat bothered by the lack of a narrow-CW filter, but I found that I could operate in all but the worst of crowded conditions by using the i-f shift control to move the i-f window into a better location with respect to the carrier. This gave the impression of an improved selectivity by removing part of the bandpass through which extraneous signals could slide. All in all, I found CW operation very satisfactory, and was delighted to be able to work about anything I could hear. Although I did not find the sidetone pitch and volume controls which are internal, I must confess that I didn't search for them either. Once the English-language manual arrives, it will be a snap to adjust them to one's own special comfortable listening level and tone. With earphones on, I found everything to be exactly right, so I didn't bother trying to change them.

Single-sideband operation is where this rig really shines. I am not much of a phone operator, and because of this I was perhaps a bit overconcerned about the modulation and signal levels that I would be able to produce. I needn't have worried; each report was outstanding.

The first evening of sideband operation went something like this: "W1XU, this is W—; you are five by nine here. By the way, what rig are you running? The audio is outstanding!" (Mic Gain control positioned at 10 o'clock.)

"W—, this is W1XU right back. Thanks, OM, for the fine report. The rig is a new one undergoing test for 73. I'm not at liberty to tell you the make and model just yet, but I can tell you it is nominally a 100-Watt-output rig, made offshore."

(Breaker)"W1XU, this is K—; what kind of rig did you say you were running? The audio is superb. Are you running a processor?"

"K—, thanks for the good report. I appreciate it. Can't tell you what the rig is, but you'll read about it in 73 one of these months."

(Breaker) "W1XU, this is W—. I just wanted to tell you that I have been listening to you for half an hour, and your frequency is rock steady. You haven't varied by one cycle since I started listening. I also wanted to tell you that your rig is super, whatever it is."

(Later that evening) "W1XU, this is WA—. Your audio certainly doesn't sound any better with that compressor in your circuit. In fact, it sounds better without it. Are you sure you don't have some audio processing? It's crystal-clear and has magnificent 'punch.' "

Rather than bore you with further reports of the same or similar content, I'll just mention that every report has been outstanding. I have been very careful about avoiding requests for an audio quality report, and each one was unsolicited. In spite of the fact that I consider myself a dyed-in-the-wool CW operator, this rig has gone a long way to turn me back to SSB. Maybe it will help to understand that when I admit that my voice is one of those mid-range voices that could be described as soft-spoken. It does not "talk up" a rig like many that you hear. In fact, I usually use a mike amplifier to help out... but with this rig it surely isn't necessary and probably is not desirable.

Of course, being solid-state, no tune-up is required, and full output is achieved into a matched antenna. I did not notice any swr shutdown protection at swr values up to about 1.5 to 1. Inadvertently, I once attempted to transmit with the antenna shorted to ground. Obediently, the finals shut down, and—fortunately—no damage was done. This was immediately obvious by the power output meter, which didn't even flicker. Not having any swr values in the 3:1 range, I can't be sure at what point shutdown began, but I would guess that 3:1 would result in a power output of about 50 Watts or less ... in other words, a progressive protection. Nice.

The memory function had me a bit perplexed, but I got brave enough to finally give it a whirl. I dialed in two frequencies about 50 kHz apart and committed them to memory as follows: 14.007 on dial, punch the Write button, followed by button 1. 14.007 is now in memory 1 and also displayed on the screen. (Punch the vfo button and you are able to dial in another frequency.) This time, I dialed up 14.012, depressed Write and button 2, followed by vfo. 14.012 was now in the memory 2 location. Next, I wanted to put in two more frequencies in memories 3 and 4... which I did, according to the previously described method. Now, by merely selecting any of the four memory buttons, I could instantly recall the frequency in memory. Nothing special, you'll agree—and about like any transceiver with memory.

Now, what about the autowatch function? Well, I pushed it—and guess what? The receiver goes into a scanning mode and scans between the two frequencies in memories 3 and 4! It scans very slowly—I would guess no faster than about 10 Hz/second. When it reaches the top frequency it returns to the lower one and begins scanning again. Although I don't have any particular need for that feature at the moment, I can visualize a few occasions when it might be very worthwhile to have. For example: Suppose you are looking for a friend on a particular frequency, "plus or minus QRM." Just set two frequencies above and below the intended frequency and punch autowatch! When your friend comes on, you'll hear him because the scan rate is slow enough to permit call identification before it moves on. Neat.

Frankly, I have not used audio compression except on some DX contacts, where the reports have indicated an improved readability—perhaps because of the higher average power output. There were no adverse comments as there had been on local contacts.

So far, I've not been able to find the time to install the rig in the car... but may do so in time to drive to a hamfest this coming weekend. It's a longish trip—about 400 miles each way—so that should provide ample opportunity to give the rig a real mobile shakedown. I have no reason to believe that it will perform other than spectacularly.

Is this rig for you? Well, of course, it depends upon what you are looking for. Certainly it has many nice features, including some that aren't available in the run-of-the-mill modern transceiver, and it is rugged and functional. The price is competitive, as it is squarely in the range of similar transceivers. I felt the dial was very satisfactory, and the knobs, switches, and controls equally so. The only picky-picky complaint I have (and this wouldn't bother anyone else, I'm sure) is that the small knobs have skirts that are decorated with a plastic trying to simulate metal... and it looks like plastic, not metal. If I were the manufacturer, I'd forget trying to dress it up with this charade. Leave 'em all black, and they'll be that much better for it.

You may find there is enough information available on the metering modes; all you get is rf output, S-meter, and ALC information. Upon further consideration, what more do you really need?

With this article is a handy comparison chart for you, between the HF 10/160 and two other contemporary rigs in the same price class. Look it over and decide for yourself whether you're interested. If you're like me, I think you will be... very much so!

For more information, contact NCG Company, 1275 North Grove Street, Anaheim CA 92806. Reader Service number 492.

Jim Gray W1XU
73 Staff

ICOM IC-290A/E ALL-MODE 2-METER TRANSCEIVER

The Icom IC-290A/E (A is the American version and E is the European model) is just what the doctor ordered if you are looking for an all-mode 2-meter rig. It has all the features a 2-meter op could want, and even a seasoned VHF operator would be pleased with the unit. The capabilities of the IC-290 are astounding for its small size. It operates USB, LSB, FM, and CW from 143.8 MHz to 148.2 MHz. In addition to two completely independent vfo's the 290 features five memories and a flexible band-scanning system. Yet, at 64 mm (H) × 170 mm (W) × 218 mm (D), it is smaller than many FM rigs.

On the Road

I had been wanting to try 2-meter SSB mobile for years, and finally had the chance the day the IC-290 arrived. So, I installed the radio and headed out on a business trip from Peterborough NH to New York. Before leaving, I programmed the memories for five of the repeaters I might encounter enroute and put vfo A on 144.200 MHz, the calling frequency for SSB. I set vfo B on 146.52 and set the scanner for memory scan. This allowed me to scan all seven frequencies.

Although SSB during the day is not as busy as FM, there is still a considerable amount of activity, with new stations on the air every day. I could leave the rig in FM scan, and when a station came on 144.200 MHz the squelch would open and all I had to do was switch to USB to see who was calling. This system worked very well. I worked several stations between New Hampshire and New York. The added range on 2 SSB and the lack of beepers, timers, and kerchunkers is truly a pleasure. My friends on "the low end" may be upset by my publicizing their secret, but there is plenty of room for everyone. It reminds me of a bumper sticker seen on a car up here in New Hampshire after a particularly large influx of "flatlanders." "Keep NH a Secret," it read. Well, it's hard to keep a secret about something so great, and 2-meter SSB is the same.

Technical Highlights

The rf amplifier and first mixer circuits of the IC-290 use MOSFETS which allow for a receiving system that is more sensitive than any other 2-meter multi-mode rig I have tried. Unlike other transceivers, the 290 does not need a preamplifier for successful operation. I took the rig with me on a trip to Boston and tried to work a repeater in NH while in the back yard of another that was 15 kHz away. Contrary to other receivers that I had put through the same test, the IC-290 came through with flying colors. The receiver features selectable agc in SSB and CW plus a noise blanker that worked very well in removing ignition noise that was being radiated by my auto and adjacent vehicles as well.

The Icom 290 has two continuous-tuning vfo's. What this means is that when you get to the end of the tuning range (i.e., 148.200) the vfo automatically switches to the bottom edge (143.800). This feature saves a lot of time if you are on 147.51 MHz and you want to QSY to 144.220 MHz. In the SSB and CW modes, quick tuning in 1-kHz steps is available or, with a push of the front panel tuning rate switch, fine tuning in 100-Hz steps. On FM, the tuning rates are 5 kHz and 1 kHz. The tuning knob has click stops which allow for eyes-on-the-road tuning. A

priority switch allows you to sample any one of the memory channels every five seconds, regardless of whether the scanner is on or another frequency is being listened to. The S-Meter/Rf-Output indicator is of the currently-popular LED-bar type.

The transmitter in the IC-290 has a high output of 10 Watts. By pulling out on the squelch knob, you are in low power which comes through from the factory set at 1 Watt and is internally adjustable. Transmitted audio reports that I received were all favorable. The repeater offsets are controlled by two front panel switches. To the left of the main tuning knob is a three-position offset switch, selecting either up, down, or simplex. The offset frequency is selected by placing the mode switch in the Offset/Write position and dialing the main tuning knob to the desired offset frequency. Then you return the mode switch to the FM position and your offset is set until you change it. Internal transmitter controls include everything you should need from deviation-adjust in FM to CW sidetone-adjust.

Icom has provided an excellent operating manual. It includes inside photographs with all internal adjustments very well labeled. In fact, the manual is so good that Jeff DeTray WB8BTH used it to describe to me over the phone where the deviation pot was located. The manual with all its descriptive pictures was at his house and the rig was on my bench. He found the pot and described to me exactly where it was in just a matter of seconds. There is no need for an extra-cost service manual just to make adjustments.

With the IC-290A/E, Icom has once again demonstrated its ability to pack many features into an extraordinarily small package. And yet they've done it without sacrificing operator convenience. As the sunspot cycle declines and all-mode rigs proliferate, we can expect to see more and more SSB and CW activity on 2 meters. Radios like the IC-290 will bring lots of new blood to the low end of two.

For further information, contact *Icom America, Inc., 2112 116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

Bob Cunningham K1XR
***73* Staff**

HF ANTENNAS FOR ALL LOCATIONS

L. A. Moxon G6XN scarcely needs an introduction to at least two generations of antenna enthusiasts. His fascinating descriptions of antennas of all kinds, ranging from beams to vertical and from wire antennas to space-saving and "hidden" antennas, have inspired thousands of radio amateurs in this country and abroad to try their hand at just one more antenna. More often than not, the G6XN antenna will exactly fit the requirements and will perform at least as well as—and sometimes better than—whatever you may have tried before.

Les Moxon's articles, sketches, and ideas have appeared in the RSGB publications, in *QST*, and in collections and manuals everywhere. Now, at last, we have the man all by himself in a book that is bound to become a must for the bookshelf of every right-thinking antenna experimenter: *HF Antennas for All Locations*, published by the Radio Society of Great Britain, 35 Doughty Street, London WC1N 2AE, England ($12).

Here is a book you can really get your teeth into—one that you can use to answer questions you may have about a particular aspect of theory or to build a practical antenna from a concise sketch with exact dimensions for the frequency of your choice. Not only that, the English seem to have a unique way of making difficult subjects seem very simple, and Moxon's book is no exception. His explanations and drawings of the ionosphere, for example, are quite fascinating, and show a three-dimensional space in two dimensions by some very clever art work.

Let's for just a moment peek into the contents and see what's there that may interest you and have application to your particular situation. (I'm convinced that Les has something for every antenna taste and persuasion.) The book is divided into two basic parts. Part I is titled "How antennas work," and covers in ten chapters the following subjects: Taking a new look at HF antennas; Waves and fields; Gains and losses; Feeding the antenna; Close-spaced beams; Arrays, long wires, and ground reflections; Multiband antennas; Bandwidth; Antenna design for reception, and The antenna and its environment.

Part II covers "Theory into practice," and includes these chapters: Single-element antennas; Horizontal beams; Vertical beams; Large arrays; Invisible antennas; Mobile and portable antennas; What kind of antenna?; Making the antenna work, and Antenna construction and erection.

As you can see, there's enough material there to fuel your winter's needs for reading matter, and sufficient practical "how to" information to occupy several year's worth of summertime building frenzy.

Take the first chapter in Part I, for example, which invites the reader to take a *new* look at HF antennas. Just what does Les Moxon mean by a *new* look? Well, let him speak for himself.

"Amateurs have been using HF antennas for 60 years or more so that some slowing down in the rate of progress might be expected. As evidence of this, some of the best antennas in use today were designed 20 to 30 years ago yet, impelled by strong incentives, the search for the 'better' ones continues unabated. At times of slow progress it is not a bad idea to look at problems from new angles, and a possible first step is to erase from one's mind the picture of 'things as they are' and concentrate, for a few moments at least, on the way one would *like* them to be. Listing the reasons why they are not and challenging each in turn can be good fun; moreover, before accepting once again the status quo, one feels entitled to convincing evidence that there are no alternatives.

"In the following pages the reader will find few such proofs but instead several challenges to existing beliefs and practices, 'proof of impossibility' being reserved mainly for the antenna gain figures frequently claimed by authors and advertisers."

Les then goes on to explain that weight, size, and cost of beam antennas must be considered to be fair game for investigation and that a reduction in these values *without compromising performance* is a worthy goal. Another goal is minimizing interfering signals, and G6XN questions whether that goal is incompatible with the goal of increased gain. Today's thinking suggests that there is no answer, but Les points out a new and striking possibility: Why not change the antenna characteristics between transmitting and receiving?

In fact, the contents of the book suggest that the desired objectives can be met with *dipole* elements only, and that loops or other configurations are not necessary—provided that one doesn't think that a *straight* dipole is necessary!

Well, this is just a taste of what the book holds, and it goes into great detail explaining how new configurations can be achieved, what they might look like, and what may be possible.

In Part II, there are some concrete examples given on the construction of minimum-size antennas that more or less fulfill the promise of the earlier portion of the book. Whatever your antenna problem may be or however limited your space or budget, G6XN has something for you.

No one suggests or would dream of suggesting that *HF Antennas for All Locations* is a panacea for antenna problems, but it is interesting and requires some study. I'd be willing to bet that seventy-five percent of us could greatly improve our HF antenna installations by reading what Les Moxon has to say. Ask your book dealer today to get you a copy. Reader Service number 493.

Jim Gray W1XU
***73* Staff**

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CONNECTICUT QSO PARTY

Starts: 1100 GMT December 4
Ends: 1100 GMT December 5

Sponsored by the Candlewood Amateur Radio Association (CARA). Phone and CW are considered to be the same contest. Stations may be worked once on each band and each mode.

EXCHANGE:

Send QSO number and ARRL section or Connecticut county.

SCORING:

Out-of-state stations multiply total QSOs by the number of Connecticut counties worked (8 maximum). Connecticut stations multiply total QSOs by the sum of ARRL sections and provinces. Additional DX contacts count for QSO points but only one DX multiplier overall is allowed. W1QI, the club station, will be operating CW on the odd and SSB on the even hours, and counts as 5 points on each band and mode. Novice contacts count as 2 points each and OSCAR contacts count 3 points each.

FREQUENCIES:

CW—40 kHz up from the bottom of each band.

SSB—3927, 7250, 14295, 21370, and 28540.

Novice—3725, 7125, 2119, and 28125.

ENTRIES & AWARDS:

A Worked All Connecticut Counties certificate will be awarded to each station working all the counties. Other awards given as usual, minimum of 5 QSO points! Logs must show category, date/time (GMT), stations, numbers, bands, QSO points, and claimed scores. Enclose a large SASE for results. Logs must be postmarked by January 2nd and sent to Steve Grouse KA1ECL, 3 Queens Court, Danbury CT 06810.

CANADA CONTEST

Starts: 0000 GMT December 19
Ends: 2400 GMT December 19

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs and everybody works everybody. Entry classes include single-operator allband, single-operator single band, and multi-operator single-transmitter allband. There are separate single-operator QRP (5 W dc, 10 W PEP out) and single-operator non-Advanced amateur classes.

Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band, once on CW and once on phone. No crossmode contacts, and no CW contacts in the phone bands are allowed.

EXCHANGE:

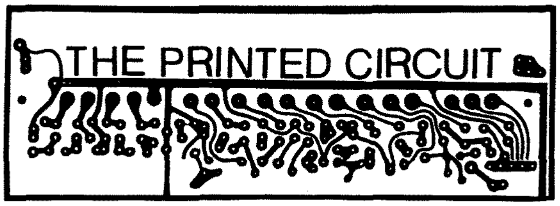
Signal report and consecutive serial number starting with 001; VE1 stations also should send their province (NS, NB, PEI).

SCORING:

Score 10 points for each contact with Canada, 1 point for contacts with others. VE0 counts as Canada. Score 10 points for each contact with any CARF official news station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band, on each mode (12 provinces/territories × 8 bands × 2 modes for a maximum of 192 possible multipliers). Contacts with sta-

CALENDAR

Dec 4-5	ARRL 160-Meter Contest
Dec 4-5	Connecticut QSO Party
Dec 11-12	ARRL 10-Meter Contest
Dec 19	CARF Canada Contest
Jan 8	*73 Magazine* 40-Meter World SSB Championship
Jan 9	*73 Magazine* 80-Meter World SSB Championship
Jan 15	World Communication Year Amateur Radio Activity
Jan 15-15	*73 Magazine* 160-Meter World SSB Championship
Jan 15-16	Hunting Lions in the Air Contest
Jan 15-10	QRP CW Contest
Feb 19-20	YL ISSB QSO Party—CW
Feb 26	RTTY World Championship Contest
Mar 12-13	YL ISSB QSO Party—Phone



NEWSLETTER OF THE MONTH

This month's winning newsletter is the *Printed Circuit*, published by the Lubbock Amateur Radio Club in Lubbock, Texas.

As well as its unique masthead, the *Printed Circuit* offers a variety of features not found in most newsletters. For example, one issue features a full-page profile of a local old-timer, which was followed by a column on personal computers.

Not leaving out other areas of interest, the editors of the *Printed Circuit* included a story on amateur participation in a recent disaster drill and devoted another full page to DX news and propagation predictions.

And that's not all—There is also a regular technical column, public service announcements, repeater update, puzzles, and a monthly activity calendar.

One sure way of divining the success of a publication is by the activity of its letters section, and the *Printed Circuit* is not lacking in that area, either. Many newsletter editors must dream of getting the number of letters received by the *Printed Circuit*.

To top it all off, the *Printed Circuit* publishes a Q & A session with "The Old Ham." The Old Ham addresses timely and pertinent subjects, such as what to do in a Toronado warning and how to tell a Toronado from a Chevy.

Hats off to Becky Swann WD5KBO and her staff for putting out a newsletter with more stuffed into it than a five-flavor banana split.

73 encourages clubs to send in their club newsletters. Just address them to *73*, Pine Street, Peterborough NH 03458. Keep us up to date with what is happening in your area, and maybe even win the Newsletter of the Month contest.

tions outside Canada count for points but not multipliers.

FREQUENCIES:

Phone—1820, 3770, 3900, 7070, 7230, 14150, 14300, 21200, 21400, 28500, 50.1, and 146.52.

CW—1810, 3525, 7025, 14025, 21025, 28025, 50.1, and 144.1.

Suggest phone on the even hours (GMT), CW on the odd hours (GMT). Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

A plaque will be awarded to the highest score single-operator, allband entry. Certificates will be awarded to the highest score in each category in each province/territory, US call area, and DX country.

ENTRIES:

A valid entry must contain log sheets, dupe sheets, a cover sheet showing claimed QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier check lists are available. Entries should be mailed within one month of the contest, with your comments, to: CARF, PO Box 2172, Stn. D, Ottawa, Ontario K1P5W4, Canada.

Results will be published in *TCA*, the Canadian amateur magazine. Non-subscribers may include an SASE for a copy of the results.

RESULTS

1982 A5 *MAGAZINE* WORLDWIDE DX SSTV CONTEST

1st DX	FM7CD	1622 pts.
1st US	KE1Y	810
2nd	VE4ADG	453
3rd	KB6WP	410
4th	VE3JW	368
5th	WD9IPX	331

(63 entries total were received)
Next SSTV contest is the WAS SSTV in January

2ND ANNUAL 40-METER WORLD SSB CHAMPIONSHIP

Starts: 0000Z January 8
Ends: 2400Z January 8

SPONSOR:

73, Peterborough, New Hampshire 03458.

MISCELLANEOUS RULES:

Work as many stations as possible on 40-meter phone during the specified times of allowable operation. The same station may be worked once. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All the multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your log(s) and on your summary sheet. Off periods are no less than 30 minutes each.

OPERATOR CLASSES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the continental 48 US states and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

1 QSO point is earned for each station worked in the continental 48 US states and Canada or within your own country. All other contacts are two points each. List points for each contact on your logsheet.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum), each Canadian province or territory (13 maximum), or DX country worked.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include a contest log, a contest summary, and multiplier checklist. We recommend that contestants send for a copy of the contest forms. Send an SASE to the contest address listed below.

CONTEST DEADLINE:

Each entry must be postmarked no later than February 12, 1983.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

AWARDS:

Contest awards will be issued in each operator class in each of the continental 48 US states, Canadian provinces and territories, and each DX country represented. A minimum of 5 hours and 50 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms or to submit an entry, forward an SASE to: 40-Meter Contest, Billy E. Maddox, 468 Century Vista Drive, Arnold MD 21012.

2ND ANNUAL 80-METER WORLD SSB CHAMPIONSHIP

Starts: 0000Z January 9
Ends: 2400Z January 9

SPONSOR:

73, Peterborough, New Hampshire 03458.

MISCELLANEOUS RULES:

Work as many stations as possible on 80-meter phone during the specified times of allowable operation. The same station may be worked once. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All the multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your log(s) and on your summary sheet. Off periods are no less than 30 minutes each.

OPERATOR CLASSES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the continental 48 US states and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

1 QSO point is earned for each station worked in the continental 48 US states and Canada or within' your own country. All other contacts are two points each. List points for each contact on your logsheet.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum), each Canadian province or territory (13 maximum), or DX country worked.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include a contest log, a contest summary, and multiplier checklist. We recommend that contestants send for a copy of the contest forms. Send an SASE to the contest address listed below.

CONTEST DEADLINE:

Each entry must be postmarked no later than February 12, 1983.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

AWARDS:

Contest awards will be issued in each operator class in each of the continental 48 US states, Canadian provinces and territories, and each DX country represented. A minimum of 5 hours and 50 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms or to submit an entry, forward an SASE to: 80-Meter Contest, Billy E. Maddox, 468 Century Vista Drive, Arnold MD 21012.

2ND ANNUAL 160-METER WORLD SSB CHAMPIONSHIP

Starts: 0000Z January 15
Ends: 2400Z January 16

SPONSOR:

73, Peterborough, New Hampshire 03458.

OBJECT:

To work as many stations as possible on 160-meter phone in a maximum of 30 hours allowable contest time. Multi-operator stations may work the entire 48-hour contest period. Stations may be worked only once.

ENTRY CATEGORIES:

(1) Single operator, single transmitter, phone only. (2) Multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the continental US and Canada transmit an RS report and state, province, or territory. All other stations, transmit RS report and DX country.

POINTS:

All valid two-way contacts score five (5) QSO points each.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum), each Canadian province or territory (13 maximum), and DX country outside the continental 48 US states and Canada.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include logsheets, dupesheet for 100 or more contacts, a contest summary sheet, and a multiplier checksheet.

ENTRY DEADLINE:

Each entry must be *postmarked* no later than February 19, 1983.

DX WINDOW:

Stations are expected to observe the DX window from 1.825-1.830 MHz as mutually agreed by top band operators. Stations in the US and Canada are asked not to transmit in this 5-kHz segment of the band. During the contest all stations are requested to utilize those frequencies from 1.808-1.825 and 1.830-1.900 MHz.

DISQUALIFICATIONS:

Operator omits a required entry form, operates in excess of legal power authorized for his/her given area, manipulates operating times to achieve a score advantage, or fails to omit duplicate contacts which reduce the overall score more than 2%.

AWARDS:

Contest awards will be issued in each entry category in each of the continental US states, each Canadian province and territory, and each DX country represented. A minimum of 5 hours and 50 QSOs must be worked to qualify.

CONTEST ADDRESS:

To obtain entry forms or to submit a contest entry, forward an SASE to: 160-Meter Contest, Billy E. Maddox, 468 Century Vista Drive, Arnold MD 21012.

2ND ANNUAL RTTY WORLD CHAMPIONSHIP CONTEST

Starts: 0000Z February 26
Ends: 2400Z February 26

SPONSORS:

73 and *The RTTY Journal.*

MISCELLANEOUS RULES:

The same station may be worked once on each band. Crossmode contacts do not count. Single-operator stations may work 18 hours maximum, while the multi-operator stations may operate the entire 24-hour period. Off periods are no less than 30 minutes each and must be noted in your log(s).

OPERATOR CLASSES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

ENTRY CATEGORIES:

(A) Single band. (B) Allband, 10-80 meters.

EXCHANGE:

Stations within the continental 48 US states and Canada must transmit an RST report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RST report and consecutive contact number.

QSO POINTS:

1 QSO point is earned for each valid contact.

MULTIPLIER POINTS:

1 multiplier point is awarded for each of the 48 continental US states, Canadian provinces or territories, and DX countries worked on each band.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Entries must include a separate log for each band, a dupesheet, a summary sheet, a multiplier checklist, and a list of equipment used. Contestants are asked to send an SASE to the contest address for official forms.

ENTRY DEADLINE:

All entries must be postmarked no later than March 26, 1983.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

AWARDS:

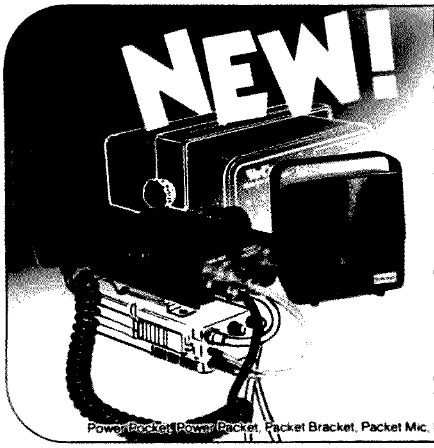
Contest awards will be issued in each entry category and operator class in each of the US call districts and Canadian provinces and territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 5 hours and 25 QSOs must be worked to be eligible for awards.

CONTEST ADDRESS:

Send an SASE to RTTY World Championship Contest, c/o *The RTTY Journal*, PO Box RY, Cardiff CA 92007.

WORLD COMMUNICATION YEAR

Next month's World Communication Year amateur radio activity will be using the 75 ITU zones for scoring multipliers. Be sure you use the correct ITU zones and not the ARRL zones for this contest. Copies of a world map and prefix list showing the ITU zones can be obtained from the contest sponsors, the Potomac Valley Radio Club, by sending an SASE or an IRC to: PVRC, PO Box 337, Cromsville MD 21032. Complete rules will appear here in my January column.



Introducing the POWER PACKET™ from VoCom

An innovative new product that you can combine with your VoCom Power Amplifier to obtain the functions of the famous VoCom Power Pocket™ *using any handheld radio.*

AF POWER — 2 to 3 watts of road-noise-overcoming audio to your vehicle speaker or to external Packet Speaker™ (optional).

EASY HOOK-UP — Packet Bracket™ at bottom of Power Packet, provides place to clip almost any make or model handheld. Connects to handheld through pin jacks. Hooded light on Power Packet illuminates portable's front panel.

CHARGE POWER — 35 mA charge on receive, 400 mA when mic is keyed. Unless your handheld draws more than 400 mA, you can talk as long as you wish and the batteries will be at least as charged as when you started.

MIC PREAMP — adjustable; tie in your handheld directly without changing its mic input. Also makes Power Packet compatible with most standard mobile mics. Optional Packet Mic™ available.

Suggested retail $84.95. See your favorite amateur radio dealer.

VoCom
PRODUCTS CORPORATION
65 E. Palatine Rd., Prospect Heights, IL 60070
(312) 459-3680

✓90

Power Pocket, Power Packet, Packet Bracket, Packet Mic, Packet Speaker and VoCom are trademarks of VoCom Products Corp.

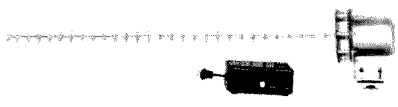
MICROWAVE AND SATELLITE TELEVISION

The standard RP downconverter package shown below gives you a proven 2150 Mhz downconverter mounted in a weathertight antenna that features low wind loading and easy installation.

All downconverters use microstrip construction for long and reliable operation. A low noise microwave preamplifier is used for pulling in weak signals. The downconverters also include a broad-band output amplifier matched to 75 ohms. The RP model is recommended for up to 15 miles. Over the range of 15 to 25 miles the RP+ which has a lower noise and higher gain RF amplifier stage, provides better television reception. For installations over 25 miles, an RPC unit which uses a separate antenna is available. All models are transient voltage protected by surge protection on both the power supply and the converter inputs. All models are warranted for one year.

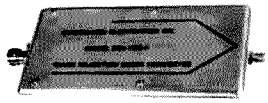
The DCI 466 is a completely self-contained **IMAGE REJECTION DOWN CONVERTER** that is used for TVRO downconversion at the Satellite antenna where optimum signal to noise ratio can be obtained. The DCI 466 converts the TVRO band to 70 Mhz. The unit's DC power and a 17 to 25 volt local oscillator tuning voltage are superimposed on a single RG 59 line for easy installation. The unit has an on board IF amplifier matched to 75 ohms that gives plenty of drive for long cable runs. The overall conversion gain is 25db. Image rejection is a minimum of 14db. $300 in singles.

Write for details on our low priced model VCO 40 voltage controlled oscillators in the four pin TO-8 package that cover the TVRO band. Also check our 120 degree low noise amplifier for low cost satellite ground stations.



INTEGRATED ELECTRONICS
PO BOX 204
CARLISLE MA 01741
617-369-0536

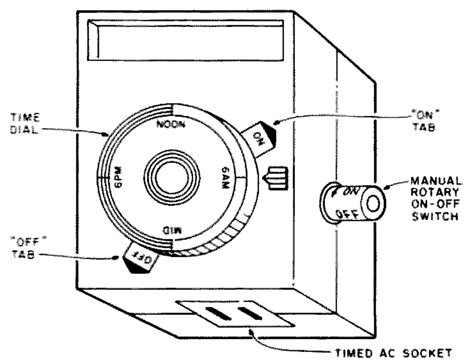
✓165



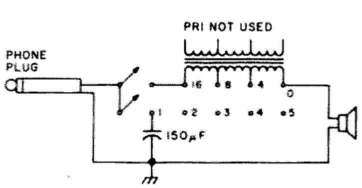
CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

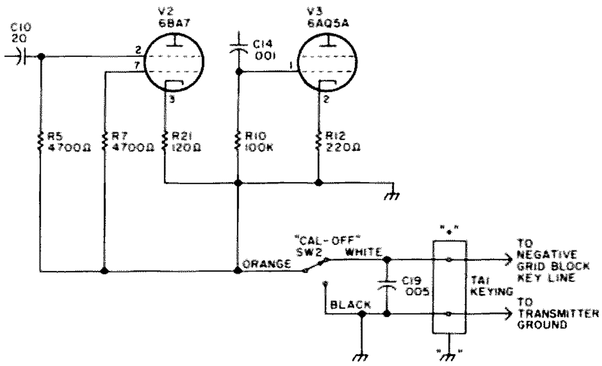
In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73* Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*



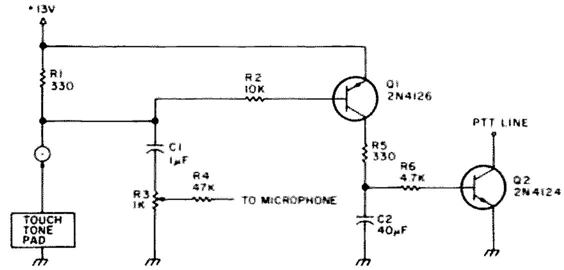
OVERTIME PROTECTION FOR NICADS: Nicad batteries are prone to damage if the batteries are charged for more than 12 to 16 hours. Unfortunately, most timers don't have a timer. To protect your batteries from possible overcharge and venting, you can add an outboard timer and thus protect your batteries. 24-hour appliance timers are available for less than $10. The timers have sliding "on" and "off" tabs which trip a switch when the dial rotates. There is also a rotary-type override switch on the back or side of the unit. To use this timer for your nicad charger, first disassemble the timer. Remove the tab from the "on" switch. To use the modified timer, set the dial to noon and set the "off" switch to a time 16 hours later. This would be 4:00 am. Plug in the charger to the timer, and turn the timer on with the manual override switch. If you have to interrupt the charging cycle and move the unit into another location, your unit will have a "memory" and the charging cycle will resume at the same time when you reconnect the unit.—John F. Sehring WB2EQG, Oradell NJ.



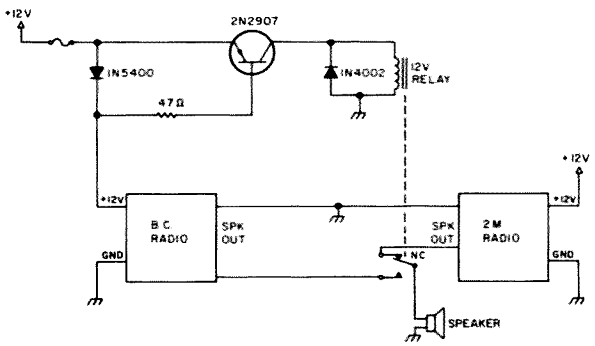
SIMPLE FILTER SPEAKER: There is nothing magical about this circuit. It consists of a universal output transformer which is secondary-tapped at 4, 8, and 16 Ohms, a 150-uF paper capacitor, and a two-deck five-position rotary switch to select combinations as shown. The clockwise position goes straight through to the speaker and each step to the left cuts more high frequencies in the manner of a typical tone control on a broadcast receiver. There is some attenuation of the overall signal (chiefly above the male voice range), so you can reduce the heterodynes from Radio Moscow and the adjacent channel sideband QRM to a tolerable level. You could use a transformer with more taps or more than one capacitor if that is what your junk box offers.—W. B. Cameron WA4UZM, Tampa FL.



HALLICRAFTERS HA-5 GRID-BLOCK KEYING CONVERSION: The Hallicrafters HA-5 vfo is cathode-keyed. This conversion will enable the rig to be grid-block-keyed with a minimum of surgery to the unit. Begin by disconnecting cathode resistors R12 and R21 from the orange lead of the "Cal-Off" switch, grounding them to chassis. Open R22 at the TA1 keying terminal strip. Disconnect R5, R7, and R10 from chassis, and connect their junction to the orange lead of the "Cal-Off" switch. To reconvert to cathode keying, disconnect the ungrounded ends of R5, R7, R10, and R22, leaving them bent out, while installing new R5, R7, and R10 resistors whose long leads will more readily reach to the orange "Cal-Off" switch lead. The grid-block transmitter lead (negative) then connects to the terminal marked "+", and the transmitter ground connects to the terminal marked "ground" on the vfo keying terminal strip.—Tuckerman S. Jalet AA1C, Stamford CT.



TOUCHTONE™ TECHNIQUES: This circuit allows for one-hand operation of any surplus-type touchtone pad. Q1 and Q2 form a high-low switching circuit controlled by R1. When any key is depressed, Q1 will conduct, applying 12 volts to the pad. Then Q2 conducts, keying the transmitter. After you have completed dialing, the keying circuit returns to the "rest" mode and the transmitter must be keyed by the PTT. Delay time is controlled through selection of C2 and R6. Component values are not critical.—Joseph A. Taylor W9JO, Green Bay WI and Hugh Kelley WB9NON, Rhinelander WI.



SUPER AUTOMATIC SPEAKER SWITCH: This circuit will switch a speaker between your broadcast radio and your two-meter rig, depending on which radio is turned on at the time.—Halm Sandel KB2IV, Flanders NJ.

1982 INDEX

HAM HELP

I need a manual or a copy of it for the Globe Scout model 680-A. I will gladly pay all costs.

Dennis Cornell
7835 Captain St.
Millington TN 38053

I am looking for the following: MK 731/ARC-51X, H-157/AIC, H-158/AIC, ME-57/U, USM 281E, ME-11/U, URM-120, URM-127, O-1131/GRC, URM-103, AN/AIC-25, PRC-49, PRC-90, URC-10, ARA-50, SRD-7, URD-4, OA-3633/ORC, R442/VRC, RT524/VRC, PRC-74B, RT-662/GRC, R1051/VRR, 61BT, ARC-159. I also need modules for the following: ARC-58, SG-179A, AM1528B/URC, CV465C/URC, RE-284/URC, 0-655/URC, MC-286B/URC, KY-305/URC, CV-466A/URC, CV-987/GRC-110A, AM1525/URC, AM-476C/AIC-10 unpotted, CU786/TRC-75, CU749/TRC-75, C2848/TRC-75, URM-124, MK-500/U, 878L-3, GRM-21, GRM-10, CU-523/ARC-58, C-1939/ARC-58, R1149/ARC-58(v), C-1940/ARC-58, R-1283/GRC, R484/APR-14, APR-13, URT-23(v), AM-1780/VRC, H-250/U, RT834/GRC, R1123/ARC-73, C-4074/RC-73, C-3940/ARC-94, URM-205, VRM-1, and USM-223. I am also seeking any documentation on the ARC-58, TRC-75, and ARC-159, and I would like to hear from anyone using the TRC-75.

Leroy Ritta
PO Box 102
St. Marys 5042
South Australia
Australia

I need the 20-meter heterodyne oscillator coil (part no. 40-771) for my Heath SB-301 receiver.

George Savino KV2V
388 N. Monroe Ave.
Lindenhurst NY 11757

I would like a schematic for an Allied Star Roamer receiver, number 22-3993-710042-713.

Joe Hustak WA5ZNO
6821 NW 27th St.
Bethany OK 73008

I am in need of videotapes (VHS format) of Novice- and General-class theory material. I also need good audio tapes for mastering Morse Code.

Robert M. Gallery
9214 Weathervane Place
Gaithersburg MD 20879

I need a 3CV1500 tube for my Alpha Vapor amplifier.

David Ornee KA9JKQ
4615 Howard Ave.
Western Springs IL 60558

I need help correcting a severe drift problem in the lmo/vfo of my Heath SB-102. Anyone with information on this problem or who can fix it, please write.

Harold Wright K4MFN
Rt. 1 Box 259
Chancellor AL 36316

I am trying to find a 3-inch picture tube, type C6407, for a Symphonic model TPS-30 television. I would also be interested in buying the entire set if the picture tube is good.

Al Duester
179 Woods Hole Rd.
Falmouth MA 02540

I am badly in need of the manual or schematic for Navy surplus receiver R808/GRC-14, a unit of radio set AN/GRC14.

Lee A. Grunewald K5JGZ
1020 K St. NW
Miami OK 74354

I need the construction manual and schematic for a Dycomm 2-meter linear amplifier. I will pay for the original or copying costs and postage.

Marvin Rosen N3BOA
20 W. Madison St.
Baltimore MD 21201

Wanted: 40-kV, 0-200-pF vacuum variable capacitor.

Cliff Young WA2TGY
PO Box 790
Parker CO 80134

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

LMRE AWARDS

Here are the details of an awards program recently instituted by the Liga Mexicana de Radioexperimentadores (LMRE) and open to all amateurs anywhere; there are currently four awards offered.

6Z6 Award

Available for confirmed contact with any 6 Mexican stations after January 1, 1980.

American Award

Requires confirmed contact with 40 countries in the Western hemisphere (ARRL DXCC list) plus 10 contacts with XE stations.

Mexico Award

Requires confirmed contacts with 20 stations in Mexico.

Worked All XE (WAXE)

Requires 25 confirmed contacts, 15 with XE1, 5 with XE2, and 5 with XE3 stations.

Awards cost US $3.00 or 10 IRCs each and require that either the QSL cards or a list certified by the awards secretary of the local league be submitted to the LMRE of Mexico City. If QSL cards are submitted, be sure to include sufficient funds for return of same via international registered air mail. The address for applications is: LMRE Awards Manager, c/o Manuel De Lera, PO Box 907, Mexico 1, DF, Mexico.

JOLIET AMATEUR RADIO SOCIETY

The Joliet Amateur Radio Society is sponsoring the JARS award. Illinois stations must contact 10 JARS members. Continental US stations must contact 5 JARS members. No repeater contacts. An updated membership list is available on request for an SASE or 2 IRCs. Send list of log information and $1.00 (DX station may send 3 IRCs) for the award to: Paula Franke WB9TBU, Certificate Chairman, PO Box 873, Beecher IL 60401.

THE IOWA AWARD

An award will be issued to any amateur who has worked 19 Iowa counties. Cost will be $1.00. Each additional 20 counties will earn a new award. QSLs not required. Send usual log information and statement by two other amateurs or one club officer to the Mississippi Valley Radio Club, 3518 Columbia, Davenport IA 52804.

THE PLANET EARTH AWARD

The South West Ohio Repeater Club (SWORC) takes great pleasure in presenting the Planet Earth Award. To qualify, applicants must submit proof of QSOs with 10 different stations on the planet Earth. There are no restrictions, but QRP operations will be noted. Send your list of contacts along with the award fee of $4.00 or 12 IRCs with an SASE to the Awards Chairman, South West Ohio Repeater Club, PO Box 18005, Cincinnati OH 45218.

WORKED ALL MORTON AWARD

The Morton Amateur Radio Club has announced its new award program. The Worked All Morton award is issued to those hams who have had QSOs with five members of the Morton Amateur Radio Club, or hams living in Morton, Illinois. Only contacts made on or after January 1, 1981, will count. To receive the award, applicants should send log information listing at least five Morton contacts along with a large SASE to Morton Amateur Radio Club, 701 Columbus Avenue, Morton IL 61550.

The club operated a special events station, W9EEB, during the Annual Morton Pumpkin Festival. An attractive certificate for the Pumpkin Award will be sent to all who QSL. The operation was held September 16 through 18, 1981, on 7.280, 14.280, 21.380, and 28.680 MHz. The award will be issued on receipt of QSL and a large SASE by W9EEB, 701 Columbus Avenue, Morton IL 61550.

In an effort to restore good operating practices to the amateur bands, a group of Morton Amateur Radio Club members have undertaken the sponsorship of the All American Alligator Award. This probably least-coveted certificate will be issued to those stations which exhibit acts inconsistent with the spirit or laws of amateur radio. We hope the award will be received in the same spirit with which it is being issued.

TEN-METER FM AWARDS

Sponsored by the North Whidbey Island Repeater Association (NWIRA), all contacts must be made on or after January 1, 1981. Crossmode contacts do not count. Contacts must be two-way ten-meter FM. Special endorsements include All-Mobile, All-Simplex, Single-Frequency accomplishments, and contacts made within a single day, week, month, or year. *Do not* send QSL cards; forward your list of contacts showing the date, time, and frequency of each QSO and provide a brief station description. Send with the fee of US $4.00 for each award to the attention of: Ten-Meter FM Awards Program, 2665 North Busby Road, Oak Harbor WA 98277.

Worked All Districts

To qualify, applicants must work one ten-meter FM station in each of the ten US call districts.

Worked All States

Applicants must work a minimum of 50 US states on ten-meter FM.

Centurion

This award requires the applicant to work a minimum of 100 stations on ten-meter FM.

DX Decade

Applicants must work a minimum of ten DX stations outside the fifty US states and Canada on ten-meter FM.

North American

To qualify, applicants must work all ten US call districts, a minimum of six Canadian provinces and/or territories, and at least four DX countries within the North American continent (other than the US and Canada) on ten-meter FM.

OTHER AWARDS

3rd Call District Maryland

Worked all Bowie ARC in two classes. First figure US stations, second, DX stations: class 1 = 4/2; class 2 = 2/1. Log data, SASE. No charge. To: John Rouse KA3DBN, PO Box Drawer M, Bowie MD 20715.

4th Call District Florida

Florida Skip Certificate of Merit issued on recommendation of two other amateurs for outstanding service. $1.00. Send to: Florida Skip, Box 501, Miami FL 33166.

XYL Award by Florida Skip

Only requirement is to render aid and comfort to your husband in and out of the shack. $1.00 or 4 IRCs to: Elizabeth Clark W4GGQ, 41 Lenape Drive, Miami FL 33166.

Three Thousand DX Award

North Florida ARS. Work three or more stations 3,000 miles or more distant, rag-chew-type QSOs only. Two certificates will be awarded, one to you and one to the DX stations. $2.00 to: Dale Mann N4AWI, 5433 Glorianne Circle North, Jacksonville FL 32207.

Worked Broward County Cities

Broward ARC. Stations in the Florida counties of Broward, Colliers, Dade, Glades, Henry, Lee, Martin, Monroe, or Palm Beach must work all 29 cities; others, 15. Work mobiles in Broward county. No awards for your mobile. GCR, US $1.00; DX, 10 IRCs, to: WD4RAF, 1921 NW 41st Street, Oakland Park FL 33309.

6th Call District

CHC Worked All Counties California. Issued in five classes: Class D = 20 to 28; class C = 30 to 38; class B = 40 to 48; class A = 48 to 57; class AA = 58; GCR, SWL, $3.00 endorsements, $1.00 to: Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

7th Call District

CHC awards, to: Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

Washington State Counties Award. Issued in five classes: Class D = 10 to 15 counties; class C = 15 to 20; class B = 20 to 30; class A = 30 to 43; class AA = 44.

Oregon State Counties Award. Issued in four classes: Class C = 10 to 15 counties; class B = 20 to 25; class A = 30 to 35; class AA = 36.

Nevada State Counties Award. Issued in three classes: Class C = 8 to 10 counties; class B = 10 to 15; class A = 15 to 17.

Utah State Counties Award. Issued in three classes: Class C = 7 to 10 counties; class B = 18 to 24; class A = 22 to 29.

Wyoming State Counties Award. Issued in three classes: Class C = 7 to 10 counties; class B = 15 to 20; class A = 20 to 23.

Idaho State Counties Award. Issued in four classes: Class C = 15 to 20 counties; class B = 20 to 30; class A = 30 to 43; class AA = 44.

Montana State Award. Issued in five classes: Class D = 15 to 20 counties; class C = 20 to 30; class B = 30 to 40; class A = 40 to 55; class AA = 56.

GCR, SWL, $3.00; endorsement, $1.00.

Morocco

CN8 Award by AREM. Work 15 CN8 stations on 1 band, 12 stations on 2 bands, or 8 stations on 3 bands. GCR and 3 IRCs to AREM, PO Box 2060, Casablanca, Morocco.

Diploma De La Ville Rabat by Assoc. Royale Des Radio Amateurs De Maroc, c/o CN8OB, PO Box 299, Rabat, Morocco. Work 10 stations in Rabat after January 1, 1968. All others, 5. SWL 10 IRCs, list.

India

Worked Republic of India, by ARSI, Box 534, New Delhi, India. Contact 50 different VU stations after January 16, 1950. QSLs, list, 12 IRCs.

The Gateway of India Award, by ARS of India, Western Zone. Work VUs in the Western Zone after November 9, 1957. Asia stations work 10; others, 5. GCR, 6 IRCs. To: Dady Major VU2MD, 85 Sleater Road, Petit Mansion, Bombay 7, India.

Lebanon

By Lebanese RAA, PO Box 1217, Beirut, Lebanon. Work 10 stations after July 1, 1958; with endorsement seals additional 10. No charge, GCR.

Spain

Spanish Diploma, by URE, Apartado De Correos, Num 220, Madrid, Spain. QSLs from 125 Spanish stations on CW with 60 on 3.5 or 7 MHz, 10 on 28, 15 on 21, and 10 on 14 MHz. After January 1, 1952. Send 40 QSLs, list, and return postage.

125 EA Award: By URE, Hortaleza 2, Apartado 220, Madrid, Spain. Work 125 EA stations after January 1, 1952, including all Spanish call areas. At least three contacts must be made with each (EA1 through EAØ) counting EA9 and EAØ as one area. QSLs, list, and return postage.

Romania

"YO-AD" All Districts Award. Work YO districts as follows: First figure is the number of districts to be worked, second is the number of QSOs per district. Applicants in zones 15, 16, 20: class I = 8/10; class II = 6/6; class III = 3/3. Applicants in zones 14, 17, 21, 33, 34: class I = 8/6; class II = 6/4; class III = 3/2. Applicants in all other zones: class I = 8/3; class II = 6/2; class III = 3/1. 144 MHz: class I = 4/1; class II = 3/1; class III = 2/1. There are 8 YO districts in all.

Canary Island

Work EA8 stations after April 4, 1971. QSLs, SWL, 10 IRCs to: URE, PO Box 860, Las Palmas, Canary Islands, Spain. EA and LX stations work 30, rest of EU, Central and South America work 20, North America and Africa work 10. Asia, Oceania, VHF and UHF, work 5.

Austria

WAOE Diploma. Work OE districts all CW, all phone, or mixed after January 4, 1954. Austria and adjoining countries work three stations each in OE districts 1 through 9 (with OE4 and OE9 counting as one district) using at least two different bands. At least one contact per OE district must have been made on 40 or 80 meters. Rest of EU stations: Same as above but without 40- or 80-meter requirements. GCR stations outside EU. Work one OE station in each OE district on any band (8 QSLs). GCR. Same station may be worked on all bands. WAOE SWLs for 8 districts. Send list and 10 IRCs.

Colombia

100 HK3 Award: by LCRA. Third HK zone. Coordinator for contacts with 100 HK stations after January 1, 1960. SWLs, no charge, GCR, list in alphabetical order and send full log data to: HK3VV, AP 584, Bogota, Colombia.

Double Call Award: Work HK stations with double- or triple-letter calls. Three

classes: Class C = 10, class B = 20, class A = all 26 double calls (AA to ZZ); AAA counts in lieu of AA, BBB for BB, etc. Contacts after January 1, 1960. No charge, GCR, log data to: HK3VV, AP 584, Bogota, Colombia.

CHK Award: by LCRA. Work HK stations. HK stations work 100 other HK stations, stations in Americas work 50, others work 25. HKs send QSLs, others send certified list authenticated by club official. QSLs must have been sent and received. To: LCRA, AP 584, Bogota, Colombia.

ZHK Award: by LCRA. Confirmed contacts with HK zones. HKs send QSLs from all 10 zones. Americas work 9, rest of the world work 8. All except HKs send list certified by club official. To: LCRA, AP 584, Bogota, Colombia.

(No charges given for any of the LCRA awards.)

HK7 Award: by RC Santander, PO Box 222, Bucaramanga, Colombia. Work 7 HK stations, either all CW or all phone, after January 1, 1962.

10 HK1 Award: by RC Del Atlantico, Apartado Nacional 184, Barranquilla, Colombia. Work 10 HK1 stations post World War II. GRC—certified by club officer. (No costs given.)

HK5 Award: by LCRA. Work HK5 stations after January 1, 1957. American countries work 12, Colombian stations work 20, rest of the world work 8. GCR list to: Box 6149, Cali, Colombia.

US Navy Award

Work 5 US Navy ships. To: Office of Naval Communications, Director, Navy MARS (OP945N), The Pentagon, Washington 25 DC 20301.

Radioman Submarine Award: Work 2 amateur radio stations on board submarines of Submarine Squadron Twelve plus club station W4YVS or any station on board the *Bushnell*. After January 1, 1961. Notarized log information with statement that the information is true and accurate to: Radio Amateur Club, Submarine Squadron 12, Naval Station, Key West FL 33040.

ARGONNE ARC

The Argonne Amatuer Radio Club plans to operate the club's memorial station, W9QVE, to commemorate the 40th anniversary of the first controlled nuclear chain reaction experiment conducted at the Alonzo Stagg field on the University of Chicago campus. Two stations will operate from 1500 GMT December 4 through 2400 GMT December 5.

Frequencies: phone and CW—20 kHz up from lower edges of the General portions of the 80-10m bands; Novice—40 kHz up; 2m—145.19/144.59, 146.52, and 147.42; RTTY—14.090 and 146.70. Send a business-type SASE or $1.00 for an 8" × 11" unfolded certificate to AARC, PO Box 275, Argonne IL 60439.

BETHLEHEM WV EXPEDITION

The Triple States Radio Amateur Club will operate daily from Bethlehem, West Virginia, December 9 through December 12, from 1400 to 2300 UTC. Operating frequencies for WD8DDL/8 will be 7.275, 14.325, 21.425, and 28.550 MHz on SSB, and 7.110, 14.075, 21.110, and 28.110 MHz on CW. A special holiday certificate will be sent to all those contacted who send an SASE to TSRAC, 26 Maple Lane, Bethlehem, Wheeling WV 26003.

CHRISTMAS VILLAGE

The K1BCI C/Q Radio Club will operate a special event station honoring the 35th anniversary of the Christmas Village located in Torrington, Connecticut. The club will operate from the Christmas Village from December 11 through 19, 1982, on 10, 15, 20, 40, and 80 meters. Certificates of this event will be issued for contacts made. For further information, contact Jim WA1YZA or Nellie WB1DVC.

SANTA CLAUS

The Pike County Amateur Radio Club of Winslow, Indiana, will operate a special events station from Santa Claus, Indiana, from 1700Z December 18 through 1700Z December 19, 1982. The callsign will be W9CZH. Operating frequencies will be (plus or minus QRM) 21.395, 14.305, 7.265, 3.925 phone, 7.133 CW, 14.093 RTTY, and 146.52 FM. Certificate for QSL and SASE to Santa Claus, PO Box 111, Ireland IN 47545.

CHESTER GREENWOOD DAY

The Sandy River ARC will operate KA1CNG on Saturday, December 18th, 1500Z, to Sunday, December 19th, 2100Z, in celebration of Chester Greenwood (inventor of the earmuff) Day. We will also operate mobile from the Chester Greenwood Day Parade and related activities on Tuesday, December 21st, 1400Z to 2100Z. Frequencies: 5 to 10 kHz from bottom of General band edges and 3940 kHz. Certificate for your QSL card and two first-class stamps (no envelopes please) to KA1CNG, 5 Franklin Ave., Farmington ME 04938.

HONG KONG ACTIVITY

The Hong Kong Amateur Radio Transmitting Society (HARTS) is pleased to announce that once again there will be a VS6 activity day between 0001G Saturday, April 2, 1983, and 2359G Sunday, April 3, 1983. As in previous years, many VS6 stations will be active on all bands/modes.

1983 is World Communications Year (WCY), and during 1983 the special callsign VS6WCY will be in use by the HARTS club station. Special QSL cards will be issued for QSOs with VS6WCY. QSLs for WCY station should be sent to the Hong Kong QSL Bureau Manager, PO Box 541, Hong Kong.

WORKED ALL NORTH POLE

The Borealis ARC will present, upon receipt of the request with the callsigns and dates worked of a minimum of three BARC members and $2.00, a Worked All North Pole certificate. Operating time will be from approximately 0400-0900Z, 30 kHz up from the lower edge of the Novice and General bands, plus or minus QRM. The club member whose callsign appears on the largest number of certificate requests during the month of December will win a prize. Certificate requests should be sent to: Borealis ARC, c/o Wendall Keller, SR Box 80343, Fairbanks AK 99701.

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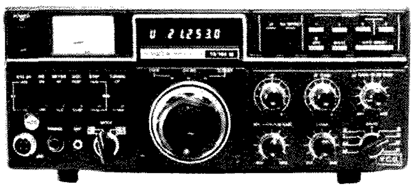

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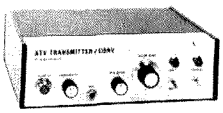

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THE TEN-METER BAND

Many DXers abandon the 10-meter band as sunspot numbers fall. But 10 meters provides DX excitement even at the bottom of the sunspot cycle. Not as much, to be sure, as when 10 is wide open to three continents at once, but, still, there is plenty of action. Because 10 meters lies at the dividing line between HF and VHF, it displays some of the propagation features of each part of the spectrum. By learning to recognize the different modes of propagation and practicing the operating patterns unique to each propagation mode, the DXer can quickly improve his success on 10 meters. The second weekend of the month of December provides a fine opportunity to practice this skill, in the ARRL 10-Meter Contest.

Let's look at the various ways DX signals get from here to there, and how the DXer should modify his operating techniques to take full advantage of each propagation mode.

HF Spectrum

Most DX contacts are made via the F2 ionization layer of the ionosphere. The F2 layer is ionized by radiation from the sun and tends to be strongest near the middle of the day. Thus, 10 meters will open up to the east in the morning. As the Earth turns, the band opens farther south, and then it swings around to the west in the late afternoon. The DXer can recognize F2 propagation because it is so widespread, with signals from a large part of the world coming in all at once. This propagation mode is quite steady, building rather slowly and fading gradually. Normal DXing techniques will be successful: Aim your beam at the station and make your call.

Ten meters is not always "open" via F2 propagation. So some DXers will quickly tune across the band with the beam aimed east, hear nothing, and drop to 15 meters. However, even when the ionization is not strong enough to provide east-west propagation, it often is strong enough for north-south contacts. The equatorial region receives more solar radiation than latitudes farther north and often gets enough radiation to open the 10-meter band. Instead of the normal sequence of the band opening up in the east and swinging around to the west, around midday or a little later the band opens up just to the south.

WA1KID used to take advantage of this phenomenon during contests with a 4-element 10-meter beam fixed south. He could switch quickly to that antenna to watch for the trans-equatorial openings and nab the CEs, LUs, and other South Americans. The only trick to working DX via trans-equatorial propagation is to know when and where to look; if your beam is aimed east, for example, you might never hear the South Americans.

This same ionization over the equatorial regions provides one of the more interesting propagation modes on 10 meters: back scatter. Strong signals aimed south can reflect off the ionization layer over the equator and bounce down to earth, and some small portion of the signal then bounces back along the same path. Not much of a signal gets through, to be sure, since most of the energy is lost or absorbed in the multiple bounces, but directional signals will be scattered enough by the ground at the other end of the hop to send some energy *back north*.

This means that it is possible to work other stations north of the equator by pointing your beam almost due south! Backscatter signals are very weak, so both stations must point their beams toward the ionization to the south. If you hear a European signal while your beam is aimed south but the signal fades as you swing your beam up to the northeast, you are probably receiving back- or side-scatter signals. You can recognize these signals because they are weak and peak to the south, no matter in what direction the station is located.

If you hear a scatter signal, resist the temptation to swing your beam according to the beam-heading chart; the signal will disappear. (If it gets louder, you're not hearing a scatter signal!) Instead, swing your beam across the south, listening for the loudest direction, the direction of the most intense ionization, and, therefore, the most scatter. Note that both stations must be beaming south. If the DX station hears your signal and swings his beam up to the west to work you, the contact is lost.

Explaining this under the weak signal strengths of scatter contacts can be frustrating. I remember spending 20 minutes once trying to convince a station that we could make contact only if *both* of us pointed our beams south and not at each other! Whenever this W4 heard my call from New England, he would swing his beam north and lose it.

Side scatter is very similar to back scatter. The radio waves reflect off the side of the ionization region, not the underside. Again, you swing your 10-meter beam back and forth, listening for the loudest signal without regard to the direction of the other station. If you can convince the DX station *to do the same thing, you can have a satisfying DX contact.*

VHF Spectrum

Since the 10-meter band is near the VHF region it exhibits some of the exciting propagation modes of VHF bands, including meteor scatter and E-skip. These short-range propagation modes don't often provide much DX, but it helps to learn how to recognize and operate under each mode.

Meteor scatter is radio propagation off the ionized trails left after a meteor rips through our upper atmosphere. Since the Ten-Meter Contest coincides with a major meteor shower, you might well hear such signals then. Meteor-scatter signals last *only a few seconds because the ionization* region quickly dissipates. Your contact must be very short; giving your call three times probably will use up the entire opening! Listen for randomly-occuring, quite loud signals which appear and disappear very quickly. If you start a contact on one meteor burst, you may well be able to complete the contact on another burst a minute of two later if you stay on the same frequency and beam heading. Don't expect to exchange much more than a signal report, however, as meteor-scatter QSOs are extremely short.

E-skip enlivens the 10-meter band quite often. The E ionization layer is much lower than the F layer, and the maximum communication distance on a single hop is about 1200 miles, compared to twice that with F2 propagation. But multiple-hop E-skip can provide some DX contacts, thus injecting some life into a "dead" band.

Because the ionization regions in the E *layer are much smaller* than those in the F layer, the E-skip propagation is much more restricted in area. You might hear only one or two states or countries at a time, for example. E-skip signals can be very loud as well as very directional, but often you can work stations around the fringes. Say you work a few G stations but don't hear anything else. Try a call for EI, GM, GD, etc. People are always listening, and a direct call can pull them out of the woodwork. E-skip propagation is notoriously fickle, appearing and disappearing rapidly. Don't be surprised if your contact fades away in midsentence.

OSL Card Errors

However your signal gets from here to there, you will probably want a QSL card to confirm the QSO. And you had better fill your card out properly if you expect a return QSL. Almost 25% of all QSLs I have received are not filled out properly, yet there are only a half-dozen pieces of information that need to be entered. And any QSL which is improperly filled out can delay the return QSL or even end up in the circular file! Let's look at the common mistakes and how to avoid them.

The callsign. A surprising number of QSLs arrive without the DX station's call in the appropriate place. If the callsign is anywhere but in the "confirming QSO with" or "radio station" box, the QSL is invalid for awards. Don't confuse the QSL manger's call with that of the DX station.

The date. Almost every country in the world except the United States uses the sequence day/month/year for the date. 12/2/82 is February 12, not December 2. To remove all ambiguity from the date, use Roman numerals for the month, or English abbreviations: 12II82 or 12 Feb. 82. Make sure you changed the date at 2400 UTC, which occurs in the middle of the evening before, local US time. I can't tell you how many cards arrive with the date one day off.

The time. There is no excuse for using anything but UTC on DX QSLs. Local time is for local QSOs only. And if you try to convert your local-time log to UTC for the QSL card, sooner or later you will make a mistake. Keep your log in UTC and keep a UTC clock in the shack. And keep your clock accurately set to WWV. A DX station or DXpedition operating "contest style" might fill a 50-entry log page in less than 10 minutes. If the time on your QSL is off by *more than 5 minutes, the QSLer might have* to search through several pages of logs for your contact.

Frequency. Be careful not to put the *band* in this box—"Frequency 20," for example. If you change bands often (during a contest, for example), watch your log. It is very easy to change bands to work a station and forget to log the band change. Then the card has the wrong band. I always prefer to receive a card with the exact frequency, such as, 14205. Since I log my exact transmitting frequency, this can help to find a QSO with the wrong date or time.

Mode. If your QSL has this box labeled "2X," just write in the mode. If the box is labeled "mode," write "2X CW" or "2X SSB."

RST. Honest signal reports in DX are as rare as Albanian contacts. I always prefer honest reports, but usually get 59 even if the other station can barely hear me.

QSL. Always ask for the QSL if you want it. I get thousands of cards which I may assume are requests for my card, but nowhere does the station specifically request my card. If things get a little behind, I may assume these cards are answers to cards I sent, and I don't answer them. And if you need a card for a particular reason, say so: "Need 3 more cards for my DXCC, please QSL," or "Please QSL for 5BDXCC."

Other things to remember: If you work a DX station during a contest with consecutive numbers as part of the exchange, write the *other station's* QSO number on the card: "your number 1024." Don't put your own number on the card, as the DX station could care less. His consecutive number will locate your contact quickly in a long log.

Speaking of contests, be sure to mention that the contact was made during a contest, if it was. Many stations keep separate logs for contest and non-contest operations because of the special logs that contests require. So include "CQ WW SSB contest," as appropriate.

Always send a card for *each* QSO. Although it is tempting to put all your contest QSOs with a single DX station on one card, it often will slow up your response. The DX station might QSL one band at a time or, as in the case of major DXpeditions, have separate managers for each band. Splurge, and send separate cards.

Finally, write legibly and accurately. Numerous QSLs have the information so badly written that it is almost impossible to read. Or the information is mis-copied from the log. These QSLs end up in the "do tomorrow" file or the circular one. And I still have cards from five years ago in my "do tomorrow" file. . .

And now a special treat for you loyal readers of this DX column. Send me your QSL card by the end of the year and I'll put them all in a hat and draw out three cards. The lucky winners will receive: a 1983 DX Callbook, a one-year subscription to *The DX Bulletin*, the most prestigious of the DX bulletins, or a one-year subscription to the W6GO QSL List, a list of more than 5000 QSL managers which is updated every two weeks (more about this prize next month)!

So send in your cards to the address at the head of this column, right away. No cost, no obligation; just mail me your QSL card and I'll notify the lucky winners immediately. Include a slide or black-and-white photo of your shack, and I'll use the best shots. Thanks for being such devoted readers of this column.

HAM HELP

Do you need help in getting your Atari computer on RTTY or ASCII? Drop me a line, and I'll be more than happy to get you started.

Bob Holsti K7ZJD/KH2
PO Box 4426 AAFB BR
Yigo, Guam 96912

I would appreciate a copy of a schematic for an RCA #WA 504-A sine/square wave audio generator. I will be glad to pay postage and the cost of copying.

A. B. Wells WA5COH
PO Box 50
Tunica LA 70782

SATELLITES

Ariane Takes a Dive

The amateur radio space program suffered another setback on September 10. On that date, a European Space Agency (ESA) Ariane rocket fell into the Atlantic Ocean instead of achieving orbit as planned. It was the second failure in five launches for Ariane, the vehicle which was scheduled to carry the Phase IIIB amateur satellite aloft in early 1983.

This time, the Ariane carried no amateur birds, but two multi-million-dollar communications satellites on board were lost. Apparently, the rocket dove into the ocean when a third-stage fuel pump failed. If the problem turns out to be specific to the unit that failed and not a design flaw, the Phase III launch schedule may be only slightly affected and the amateur satellite could still be launched sometime this spring. Amateur satellite enthusiasts can only wait patiently for ESA to work out bugs.

Incidentally, the Ariane failure is a serious blow to ESA, which is in head-to-head competition with NASA and the Space Shuttle in the satellite launching business. With Ariane's success rate running only 60%, some ESA customers are getting edgy and may take another look at what the Shuttle has to offer.

MARECS: 0 for 2

One of the satellites lost in the ill-fated September launch was MARECS B, the second Maritime European Communications Satellite. What makes the loss particularly devastating is that the first bird in the series, MARECS A, failed in orbit without ever becoming operational. The bottom line is $250,000,000 spent without a single positive result for MARECS backers. Space flight remains an expensive business.

Thanks to *AMSAT Satellite Report*.—Jeff DeTray WB8BTH, *73* Staff.

Amateur Satellite Reference Orbits

	OSCAR 8		RS-5		RS-6		RS-7		RS-8		
Date	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	Date
Dec 1	0041	87	0127	2	0011	346	0010	343	0009	342	1
2	0045	88	0122	2	0154	14	0000	343	0006	342	2
3	0050	89	0116	2	0138	11	0150	12	0003	343	3
4	0054	90	0111	3	0123	9	0140	11	0000	344	4
5	0059	92	0106	3	0108	7	0130	10	0157	15	5
6	0103	93	0100	3	0052	5	0121	9	0154	16	6
7	0108	94	0055	3	0037	2	0111	8	0152	17	7
8	0112	95	0050	4	0021	0	0101	8	0149	17	8
9	0116	96	0044	4	0006	358	0052	7	0146	18	9
10	0121	97	0039	4	0149	25	0042	6	0143	19	10
11	0125	98	0034	5	0134	23	0032	5	0140	20	11
12	0130	99	0028	5	0119	21	0023	4	0137	21	12
13	0134	100	0023	5	0103	18	0013	3	0135	22	13
14	0138	101	0018	5	0048	16	0004	2	0132	23	14
15	0000	76	0012	6	0032	14	0153	32	0129	23	15
16	0004	77	0007	6	0017	12	0143	31	0126	24	16
17	0009	78	0002	6	0002	9	0134	30	0123	25	17
18	0013	80	0156	37	0145	37	0124	29	0120	26	18
19	0017	81	0150	37	0129	35	0114	28	0118	27	19
20	0022	82	0145	37	0114	32	0105	27	0115	28	20
21	0026	83	0140	37	0059	30	0055	27	0112	28	21
22	0031	84	0134	38	0043	28	0046	26	0109	29	22
23	0035	85	0129	38	0028	25	0036	25	0106	30	23
24	0039	86	0124	38	0012	23	0026	24	0104	31	24
25	0044	87	0118	38	0156	51	0017	23	0101	32	25
26	0048	88	0113	39	0140	48	0007	22	0058	33	26
27	0053	89	0108	39	0125	46	0156	51	0055	33	27
28	0057	90	0102	39	0110	44	0147	51	0052	34	28
29	0102	91	0057	40	0054	42	0137	50	0049	35	29
30	0106	92	0052	40	0039	39	0128	49	0047	36	30
31	0110	93	0046	40	0023	37	0118	48	0044	37	31
Jan											
1	0115	94	0041	40	0008	35	0108	47	0041	38	1
2	0119	95	0036	41	0151	62	0059	46	0038	38	2
3	0124	96	0030	41	0136	60	0049	46	0035	39	3
4	0128	98	0025	41	0121	58	0039	45	0032	40	4
5	0132	99	0020	42	0105	55	0030	44	0030	41	5
6	0137	100	0014	42	0050	53	0020	43	0027	42	6
7	0141	101	0009	42	0034	51	0010	42	0024	43	7
8	0002	76	0004	42	0019	49	0001	41	0021	44	8
9	0007	77	0158	73	0004	46	0150	70	0018	44	9
10	0011	78	0153	73	0147	74	0141	7?	0016	45	10
11	0016	79	0147	73	0131	72	0131	69	0013	46	11
12	0020	80	0142	73	0116	69	0121	68	0010	47	12
13	0025	81	0137	74	0101	67	0112	67	0007	48	13
14	0029	82	0131	74	0045	65	0102	66	0004	49	14

HAM HELP

Wanted: a relay for the Heathkit HW-12 monoband transceiver. Please send price info on how I can get one. Thank you very much.

Rick Dill WA0EDH
3007 S. 44th St.
Lincoln NE 68506

I'm looking for a 40m QRP SSB transceiver for mobile use. If anyone has a 40m QRP rig or info on converting a CB to 40, I would appreciate it if they would contact me.

Roosevelt Hamilton WD4PSW
1112 Lownde Ave.
Pensacola FL 32507

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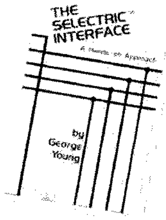

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W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

But this pursuit is a totally selfish one. There are no benefits to the hobby... to society. The world is not inched ahead one whit by these chaps. The League has let loose a monster on the world of amateur radio with their Honor Roll.

My own solution to this problem was to work hard and have fun as I worked toward 300 countries. Once I got to that level, I stopped counting. Today, when I hear a new one, I'll take a few minutes to get him in the log... preferring to talk with him if at all possible. If things are too frantic, I have better uses of my time... a lot better. I haven't the vaguest idea of how many countries I've worked and I don't intend to try to count 'em up. Perhaps, if the League would let newcomers to DXing get credit for countries worked up to 300... with no further listings after that... we might be able to put a stop to this thing.

Remember that working DX and getting up on the Honor Roll requires mainly that one be able to spend enormous amounts of time at it. This is not time spent in learning anything or in developing a skill of use to the world. Once you have a decent station, you can make a contact anywhere in the world, so it's just a question of sticking around, being there at the right time, and then bludgeoning your way through.

One of the supposed purposes of amateur radio is to help develop world friendships. Show me a hint that DX pileups and the badgering of ops in rare countries for instant contacts and a QSL generates anything but a disdain. Much of this is aimed at Americans, who are by far the worst in this regard, though at times I find the Germans pushing us hard for bad manners awards. Oddly enough, those hundreds of thousands of no-code Japanese hams are about the best-mannered operators in the whole world... and they have almost one million licensed amateurs today!

Those no-code hams, trained by their local ham clubs, often make *us* look like the CBers. They put most Americans to shame when it comes to real operating skills. And I don't think we can excuse our behavior on the air by explaining that learning the code made us crazy. I know that a lot of hams use the Morse Code as an excuse for being such terrible operators, but I don't believe that something that simple could explain what happens when a PYØ comes on the air.

And I don't think we can shrug our shoulders and put the whole thing down to basic cultural differences. The Japanese may bow when they meet, but they knock you around in the subways and in stores just as hard as you get bumped in America. No, the difference is, I believe, in basic ham training... in their club-trained hams. That's where they get across the concept of pride in being a ham and the responsibility of being a good operator.

Or, as old and good friend Bob Sullivan used to say, "I may not be wrong, but I'm not far from it."

SMALL HAMFEST CATASTROPHE

Some years ago, a disgruntled ham almost got the New England ARRL Convention closed down. The problem hinged around the breaking of federal laws having to do with the advertising of lotteries through the mail. You can't, yet most hamfests and conventions continue to do this, ignoring the federal laws they are breaking.

Please note that it is presently against the law for any hamfest or convention to send a brochure through the mail which promises prize drawings if there is a charge for attendance... and there always is. Further, it is illegal for any magazine or other publication which uses the mails to mention that prizes will be given where there is a charge for attendance.

If you want to give prizes, fine ... but it is illegal for you to mention that in anything which is going to be sent through the mails. You cannot send flyers or posters with this information on them through the mail. Got it?

No one has ever determined just how much prizes build up attendance at hamfests. As far as I know, every hamfest gives prizes, so no one *could* yet have tested the concept. With the veil of secrecy on prizes being lowered by the post office (*we* have heard from them in no uncertain terms), it may get a whole lot more difficult to get cooperation from manufacturers in the way of donated equipment.

Before the "incentive licensing" debacle of '63, it was much easier to get prizes. The ham industry was growing rapidly, meeting the needs for the then-new sideband equipment, so they were happy to donate nice prizes for our hamfests. Today, with only a handful of American firms left, most of the hamfest prizes have had to be bought, so the munificence has not been awesome. If hamfest committees decide to spend less on prizes, this would leave them

UNCLE WAYNE WANTS YOU!

When was the last time you wrote an article for *73*? Never??!! Then it is time you got started.

We are going to make 1983 the best year ever for fun, exciting articles in *73*. To do this, we'll need articles on many different topics. That's where you come in. Even if you've never written an article for us before, we want to hear from you.

What Do I Write About?

Ham radio is really about two dozen hobbies all rolled into one, so there is no shortage of interesting topics. Here are just a few:

- Antennas. Almost every ham experiments with antennas. Whether you've built a 2-meter yagi, an 80-meter quad, a helix for Phase III, or a multiband dipole, other hams can't wait to try your design. Tell 'em all about it in *73*.
- DX. Been on a DXpedition? We all enjoy reading about exotic people and places. Here's a chance to recount your adventure.
- Special Events. Hams get involved in some wacky and wonderful activities. Like Field Day from a floating raft or operating from hot air balloons. If it's worth a story, let us here from you.
- Reviews. New ham gear is released every week, so how does anyone know what to buy? You can help by writing reviews of your new equipment for other hams to read. Check with us first though; we don't want you to duplicate the efforts of someone else.
- Accessories and Gadgets. Home-brewing small projects is an amateur radio tradition. If your latest preamp, digital clock, or electronic sock warmer is a good performer, the rest of us want to hear about it.
- Major Projects. The design and construction of a transmitter, receiver, or power amplifier is a task requiring knowledge and skill. We want to publish the details so that other hams can enjoy the satisfaction of building a big project.
- Test Gear. Hams love to save money. That's why they'll be interested in your homemade test equipment. We'll have room for lots of transistor checkers, capacitance meters, logic probes, diode testers, and the like during 1983.
- Satellites. Whether it's OSCAR, RS, or TVRO, hams want to know more about building their own satellite gear. Downconverters, antennas—you name it and our fellow amateurs are eager for plans and information.
- Digital Communications. Microcomputers make RTTY neat and simple, but we can do so much more. If you are experimenting with higher baud rates, packet radio, new TU designs, coherent CW, or any of a host of other possibilities, you can tell the amateur world about it by writing articles for *73*.
- Computers. Microcomputers are fast becoming a fixture in many shacks. What are you doing with yours?

Those are just a few of the many ideas for articles. You'll think of more if you work at it.

What's In It for Me?

Cash. Unlike some ham magazines, *73* pays for the articles we publish. It may not buy you a new tower, but it might get you that new beam.

Prestige. Just imagine how impressed your friends and relatives (not to mention your boss) will be when they see your article published in an international magazine!

Enthusiasm. When you write for *73*, you help to generate the excitement that makes ham radio so much fun. Both simple and complex articles find an eager audience.

What to Do Next

For a full description of the nuts and bolts of article preparation, send for the *73* Author's Guide. If you can't wait that long, double space your manuscript, leave generous margins, carefully organize your diagrams and photos, and send the whole package to us. Our address is: *73*, Peterborough NH 03458.

Now, don't just sit there—*start writing!*

with some cash to invest in better speakers.

It's been my observation that hams will drive for hundreds of miles to hear someone interesting talk about their favorite subject. I don't know of anyone crazy enough to drive a couple hundred miles for 1/10,000th chance at an HT. You know, *you* can help. Hamfest committees really don't know who to ask to come talk at their shows. If you'd take the time to write a short review of any interesting talks you've attended at hamfests, this might get the word around.

The fact is that we do have a number of hams who get to fascinating DX spots and go through all kinds of remarkable hell in the process. Some of these chaps are most interesting, if we could only hear about it. Please take the time to pass the word to us here at *73* .. . and we'll get your material into the letters column as guidance to other hamfests.

The opposite side of the coin is that a few of our best known DXers are turkeys. It is most incredible how someone can go through some of the adventures these chaps have and be able to make it sound so incredibly dull to hear about. I once fell asleep at the dinner table trying to get anything of even the slightest interest out of two very well-known DXpeditioners.

There are plenty of interesting people around our hobby. Why not get one of our well-known ham publishers to tell about how he got his ham ticket in the '60s without knowing diddly squat about either the theory or the code? I'll bet we'd love to hear about his trip to northern Maine to get a "Conditional" license and his later trials with the FCC when they found out.

Then there is Jean Shepard K2ORS, with two successful PBS films to his credit and a third in production. Jean is by far the best humorist we have in the hobby and our hamfests should grab him when they can. I understand his latest film, "The Great American Fourth of July. . . and Other Disasters," is up for an award. If you do get him to speak, be sure to tape it and send me a copy. Shep isn't inexpensive to get, but he will pull 'em in. . . and be worth every dollar you spend.

No one really interesting is going to be cheap to get. That's the law of supply and demand. And, as Shep found out long ago, few people really appreciate anything they get for nothing.

My own experience has been that when I speak for free I often find a lack of support by the hamfest committee which results in two or three dozen in attendance. If I cost $1,000 plus all travel expenses (first class), you can bet they will be doing everything they can to get people to listen to me. Then I find myself facing two to three thousand in the audience instead of dozens. Between my already-made show commitments and trying to run my steadily-growing publishing firm while keeping up with two fast-growing industries, I'm not fishing for more work. If I do have extra time, it goes for writing, consulting, and even a touch of hamming. Most hamfests are on weekends, which is prime writing time.

In addition to getting interesting speakers for hamfests, with the no-longer-useful prize money, committees might look into putting on some really good demonstrations of new ham communications modes. I suspect that many amateurs would love to see some good slow-scan demonstrations. They'd also like to see fast-scan television. Then there is a growing interest in packet communications. But, for heaven's sake, watch out for some of the super turkey "experts" who flaunt their *doctor* titles. Several of these birds are crashing bores. Hamfest committees might, if they don't have personal recommendations on the "experts," ask for an audio tape preview and judge it as they might a radio audition.

If you have some hamfest committee members who are enthusiastic about the Morse code, why not try to inspire hams to accept code as a fun activity instead of merely something the government forces them to learn. . . and run code-copying contests, with certificates for the winners to display in their shacks. You can help bring some pride to knowing the code, something sadly lacking today. How can one have pride in something which is mandated by the government? Some of the prize money can go for awards for code skills. There's no lottery aspect to *that*.

You might get some of your more fanatic DXers to bring in their rare cards for a display. . . and for a talk on how to get the darned things. That is an art in itself. A big board for attendees to pin up their cards, with a QSL contest (also not a lottery, obviously), won't hurt.

I realize that bribery and greed are time-honored movers of people, but let's try to cope with the post office laws and find alternate ways of getting hams to come to hamfests.

THE GREAT AMERICAN HAM CLUB. . . DISASTER

When I see the Japanese ham magazine each month, with a whole section devoted to club activities. . . often with 70 or more pages of news about the clubs and pictures of their activities. . . I think of how little our clubs are doing. . . and reporting. I don't think we could generate that much news in a year, much less every month.

Even the best of our ham clubs seem to have their ups and downs. One thing that might help would be an updated series of articles on how to run a ham club. I did run such a series nearly twenty years ago and it was very well received. It's about time for an updated series, eh?

Running a ham club is show business, which many of us seem to forget. Many club presidents gather weak people around them to help make the club go. They do little to organize exciting meetings and often let business intrude on the fun . . . only to find that in a few months they have little left of the club.

I'd like to see some articles on how to make ham clubs succeed. I believe that the real strength of amateur radio lies in the strength of the clubs, not in a small group of professionals who are, for the most part, working for their own benefit first and ours second. How about some pictures of club groups and reports on club activities?

With amateur radio being a keystone, to my way of thinking, as far as providing our country with emergency communications, we're talking about club organization, not just individuals. Clubs can help get amateur radio set up so that it will be able to keep going after any kind of disaster. This means cooperative efforts to have both personal and mobile portable equipment, emergency repeaters, automated relaying, low-band interlinks, and—above all—experience. The duty is there, we already have the technology, and the work will be both fun and of help to tie us together, strengthening our clubs and our own value to our communities and country.

Then there is the responsibility of clubs to help amateur radio grow. This means devising schemes to interest teenagers in the hobby through talks at high schools, demonstrations at shopping malls, service for local groups, and participation in things like the March of Dimes. It means making sure that club activities are properly exploited with the local media. When there is a Field Day exercise, the local newspapers and television stations should get the word and be offered cooperation on the story.

Just getting the interest of teenagers isn't enough. Clubs should try to work with school officials to see that there is a radio club in the school which meets at least weekly. Schools have a serious problem about this which clubs can help solve. Any school activity has to have an adult advisor on hand. Since few schools have the budget to pay a teacher for this after-school work, the result has been a serious cutting down of after-school clubs. By providing the needed adult advisor, the local ham club could encourage the development of the school radio club.

Then there is the growing need for license classes to be put on by clubs. One of the really sad results of the Bash cheat-book approach to getting a ham ticket has been the lack of ham club members with even the small technical background it takes to teach the rudiments of theory required for the Novice exam. In some clubs, it is a case of those with scant information trying to teach newcomers, spreading confusion.

All of these problems have been solved by many clubs, so I'd like to see some letters and articles on these subjects for possible publication.

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HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" x 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

Does anyone have information on RTTY software for a TRS-80 Model I Level II?

Gary Hansen KAØJUM
Route 1 Box 103
Deerwood MN 56444

I am looking for hams with RTTY equipment who would like to help deaf students attending school in Washington DC communicate with their families back home.

Jeffrey A. Meyer N8AHA
26366 Greythorne Trail
Farmington Hills MI 48018

I am looking for a used LCR bridge such as the Leader LCR 740.

Jim Buckwalter WA6FGM
3212 Millcreek
Visalia CA 93291

I need a service manual and schematic diagram for a Hy-Gain Galaxy GT-550-A SSB transceiver. I will pay reasonable copying costs or copy and return.

Jose Sanabrais
Av. Hidalgo No. 99
Queretaro, Qro.
76000 Mexico

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Meyer Gottesman W6GIV
3377 Solano Avenue, #312
Napa CA 94558

I am blind and bedridden and searching for someone to donate a Kenwood 600 receiver or any other shortwave receiver.

Richard Jastrow
Long Beach General Hospital
2597 Redondo Ave.
Long Beach CA 90806

My club's 5-page Novice-class study guide is offered in exchange for your club's Novice- and/or General-class handouts. Ours is a brief description of the items listed in the current FCC syllabus and has a 95% pass rate in our classes.

Jim Koski KT6W
1714 Austin Avenue
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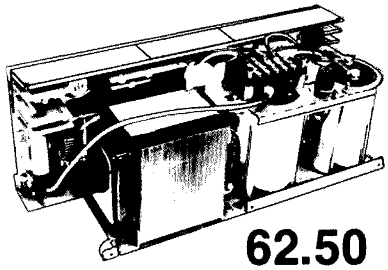

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ALASKA	14	7A	7	3A	3A	3A	7	7	14	14	21	21A
ARGENTINA	14	7	7B	7B	7B	7	14	14	21A	21A	21	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14B	14A	21	21	21A
CANAL ZONE	7	7	7	7	7	7	7A	14	21	21A	21	14
ENGLAND	7	7	7	3A	7	7B	14	14A	21A	14A	7A	7
HAWAII	21	7A	7B	7	7	7	7	7B	14	14A	21	21A
INDIA	7B	7B	7B	7B	7B	7B	14	14A	14	7B	7B	7B
JAPAN	14A	14B	7B	7B	7	7	7	7B	7B	7B	14B	14
MEXICO	14	7	7	7	7	7	7	14	14A	21A	21A	21
PHILIPPINES	14A	7B	7B	7B	7B	7B	7B	7B	14B	14B	14B	14
PUERTO RICO	7A	7	7	7	7	7	7A	14A	21A	21A	21	14
SOUTH AFRICA	7A	7B	7B	7B	7B	7A	14	21	21A	21A	21	14A
U.S.S.R.	7	7	3A	3A	7B	7B	14	21A	14A	14	7B	7
WEST COAST	14A	7A	7	7	7	7	7	14	21	21A	21A	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	7	7	3A	3A	3A	7	7	7A	14	21	21A
ARGENTINA	14	14	7	7B	7B	7	7A	14	21	21A	21A	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	7B	14	14	21A	21A
CANAL ZONE	14	7	7	7	7	7	7	14	21	21A	21A	14
ENGLAND	7	7	7	3A	7	7	7B	14	21A	14	7B	7B
HAWAII	21A	7	7	7	7	7	7	7	14	21	21A	21A
INOIA	7B	7B	7B	7B	7B	7B	7B	14B	14B	7B	7B	7B
JAPAN	21A	14	7B	7B	7B	7	7	7	7B	7B	14	21
MEXICO	14	7	7	7	7	7	7	14	14A	21A	21A	21
PHILIPPINES	21	14	7B	7B	7B	7B	7B	7	7B	7B	14B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14A	21A	21A	14A
SOUTH AFRICA	7	7B	7B	7B	7B	7B	7	14	21A	21A	21	14
U.S.S.R.	7B	7	3A	3A	7	7B	7B	14A	14A	14B	7B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21A	7A	7	3A	3A	3A	3A	3A	7	14	21	21
ARGENTINA	21A	14	7	7B	7B	7B	7B	14	21	21	21A	21A
AUSTRALIA	21A	14	7A	7	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7	14	14	21A	21A	21
ENGLAND	7B	7	7	3A	7	7	7B	14B	21	14A	14B	7B
HAWAII	21A	14	14	7	7	7	7	7	14	21	21A	21A
INDIA	7B	14	7B	7B	7B	7B	7B	7B	7A	7B	7B	7B
JAPAN	21A	14	7B	7B	7	7	7	7	7	7B	14	21
MEXICO	21	14	7	7	7	7	7	7A	14	21A	21A	21
PHILIPPINES	21A	14	7B	7B	7B	7B	7B	7B	7B	14	14	14
PUERTO RICO	21	7	7	7	7	7	7	14	21	21A	21A	21
SOUTH AFRICA	7	7B	7B	7B	7B	7B	7B	14	21	21A	21	14
U.S.S.R.	7B	7B	3B	3B	7B	7B	7B	7B	14	14B	7B	7B
EAST COAST	14A	7A	7	7	7	7	7	14	21	21A	21A	21

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			1 F/F*	2 F/F	3 F/G	4 F/G
5 G/G	6 G/G	7 G/G	8 G/G	9 G/G	10 G/G	11 F/G
12 G/G	13 G/G	14 G/G	15 G/G	16 G/G	17 F/F	18 F/F*
19 P/P*	20 P/F*	21 P/F	22 P/F	23 F/G	24 F/G	25 F/G
26 F/F	27 F/F	28 F/F	29 F/F	30 F/G	31 F/G	

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